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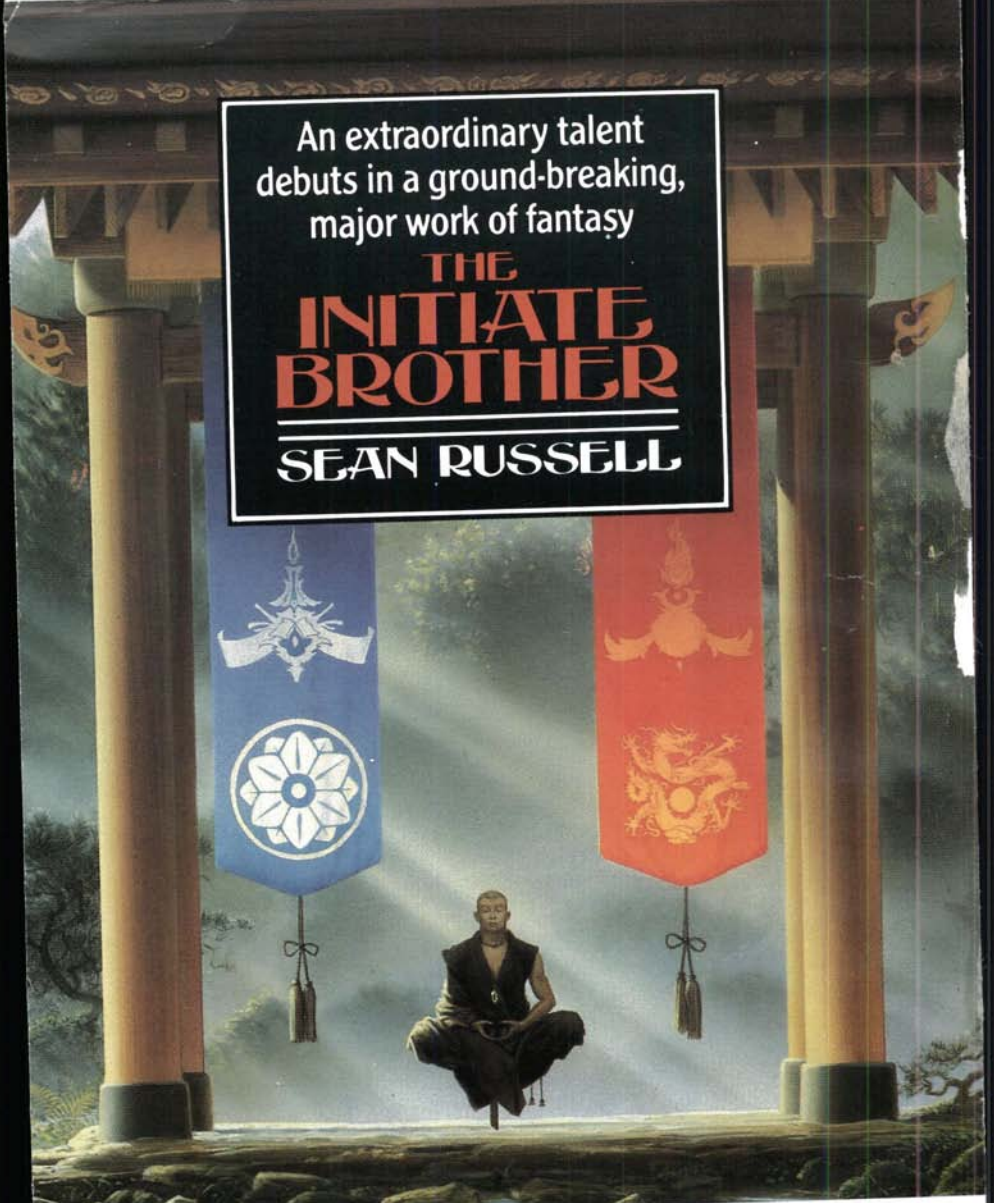

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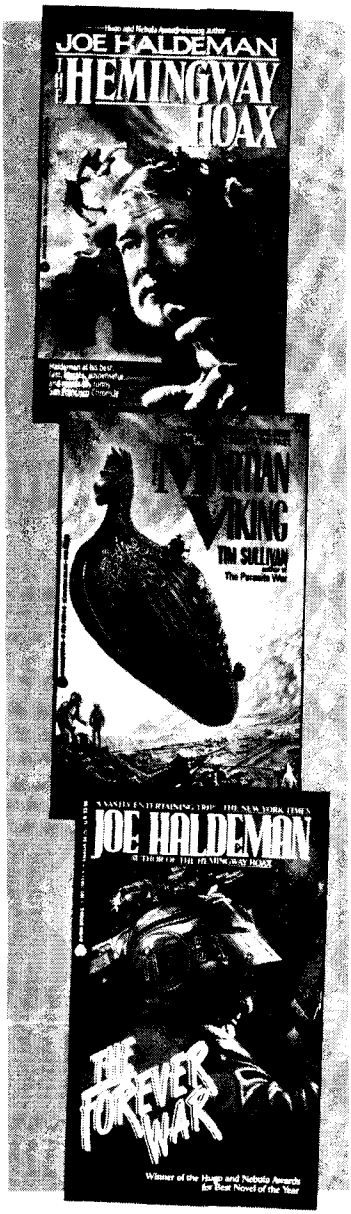
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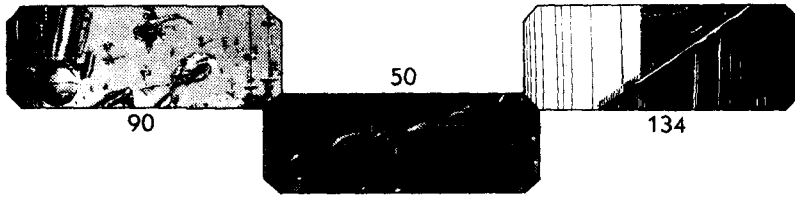

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Editorial

FOOLPROOF

Stanley Schmidt

Last year *Analog* published a story called "Funnel Hawk," by Tom Ligon, in which the heroine flew a specially designed airplane quite close—and on one occasion into—tornadoes. One reader objected vehemently to the story on the grounds that it might lead irresponsible young pilots to try to repeat the actions it described, with disastrous results. If even one young person died as a result of that story, this reader suggested, the author and I would forever bear the guilt for his death; and she hoped we would never again do anything so reckless.

I sympathized with her concern and gave her argument careful consideration, but in the end could not find it valid. No one dies as a result of reading a story. If the scenario the reader feared actually occurred—which I consider extremely unlikely—the death would result not from Mr. Ligon's well crafted and widely admired tale, but from the pilot's own stupidity or irresponsibility.

The story made it very clear that the plane it featured was no ordinary craft, and the woman who flew it was no ordinary pilot. The plane had a multitude of special design features enabling it to survive and maneuver under conditions most planes couldn't handle. The pilot was not only very talented but very experienced—and she *still* had trouble, and knew what she was doing was risky. Anyone who attempted those tricks without a comparably special plane and training would be either an idiot or a fool.

Idiot's don't fly, at least legally; the requirements for earning a license are much too demanding. Fools *may* fly, on occasion; flight school cannot guarantee that its graduates will always exercise good judgment. But if one fails to, to what extent is anyone else responsible for his actions?

Hardly any, as I see it. Indeed, it seems to me that many of our culture's recent problems stem from a failure to expect people to accept responsibility for their own actions. By itself, I would

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not consider that letter sufficient subject for an editorial. But as only one of many manifestations of what seems to me a widespread trend, it's a good starting point.

The current fashion is to place the blame for foolish behavior anywhere but where it belongs: on the fool himself. One result of that is that people who should be facing the fact that *they* need to shape up are instead encouraged to blame (and sue) other people who in some distant way helped make their foolish behavior possible. Another is that manufacturers are expected to build everything so that any idiot can use it, and writers and editors are expected to avoid even mentioning anything that might give somebody the idea of trying something stupid.

Now, I'm all in favor of building things so that they can be used with a minimum of unnecessary difficulty and are not likely to malfunction dangerously if used with reasonable prudence and skill. I'm writing this on a computer that is far easier to use than any of several I used before it, and I consider that progress with a capital *P*. I see no advantage at all in making something that's hard to use when you know how to make it easy and still capable of doing good work. Furthermore, I wouldn't consider it responsible behavior for a writer or publisher to publish "how-to" advice which he knows is wrong and dangerous.

However . . .

Fiction was never intended to be read as an instruction manual. And I see a big, crucial distinction between designing a thing for optimum performance when responsibly used, and insisting that everything be so designed that it can be subjected to any amount of irresponsible abuse without adverse consequences. The obligation to make things "foolproof" does not extend so far as making them absolutely safe for even an absolute, genuine, literal fool.

Some things *cannot* be made so that any idiot can use them. Airplanes, for instance. Flying one is a complicated business, depending on an integrated combination of highly specialized skills that can only be developed by training and experience. Using those skills also requires a finely developed sense of judgment. An airplane in the hands of somebody lacking those qualifications is, without doubt, a lethal weapon. This does *not* mean that airplanes should be banned, or that a moratorium should be declared on manned flight until airplanes *can* be made so that any unskilled dolt can fly one safely. It does not even mean that writers and publishers should refrain from writing about pilots pushing their skills beyond the point of absolute safety. It *does* mean that you take effective measures to keep people who lack the requisite skills and judgment from having command of aircraft.

An airplane is only one example of a tool which is highly valuable in skilled hands but cannot be used by just anyone. Some of the others are not so obviously dangerous, but are just as dependent on special skills. Musical instruments, for example. A Stradivarius violin can sound good enough to make thousands of people spend dozens of

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dollars each to listen to it. It can also be an instrument of torture in the hands of a player who hasn't spent years learning what to do with it.

Nor is the phenomenon limited to *complicated* technology. People can find a way to make practically *anything* malfunction, or to turn it from constructive to destructive uses. As simple a tool as an axe or a knife is surely a dangerous weapon when wielded by someone who chooses to treat it as such, or who hasn't learned how too handle it properly. It's also an extremely *useful* device in the hands of someone who understands the benefits it can produce, and how to protect himself and others from the incidental dangers.

Completely aside from the fact that we *need* the beneficial effects of many tools which can't be made completely foolproof, a case could be made that there's some intrinsic value in having a few around that can be dangerous if misused or abused. Our culture has tended to remove as many evolutionary pressures as it could from our species, by making it easy for just about anybody

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to survive. There are advantages to this, of course, both in terms of humanitarian values and in terms of actually contributing something to the species' future. Some of our most productive minds have been in bodies which would not have lived long in centuries or even decades past. This has been to everyone's advantage and credit. Even in cases of mental disability, most of us would agree that today's more compassionate attitudes are an improvement over those prevalent in the past.

But the fact that society here and now can support and encourage members who would not have survived in the past does not result entirely from our being persons of better will than our ancestors. That is, in fact, questionable. Our more "enlightened" behavior is, to a greater extent than most of us would like to admit a luxury which we can afford because of modern medicine, agriculture, and other technologies. The technological infrastructure that makes it possible is big and powerful, but also fragile and vulnerable.

Civilizations *can* collapse, as history has shown repeatedly. If ours should do so, the next is likely to arise sooner and more successfully if the survivors include a good number of people who are well prepared to cope with a wide range of challenges. They would need, in other words, intelligence, competence, and good judgment. Tools that require a certain amount of those qualities are one of the few things we have left that tend to select for them. I'm *not* suggesting that axes and knives should be left lying around among people who have been diagnosed and isolated as unable to function as parts of normal society. But among those who are attempting to do precisely that, I see no reason why specialized skills and common sense should not be among the things expected of them—of why lapses in those areas should not carry their own penalties.

Such arguments, of course, make many people extremely uncomfortable (and hot under the collar). If you don't like them, feel free to skip over them —but please consider the next. I see one more danger in the current fashion for making everything Absolutely Safe, and that is related to another kind of evolution: cultural.

A while back I mentioned the concept of a moratorium on manned flight until it can be made perfectly safe. I haven't actually heard anybody suggest that—but I have heard people propose something very similar in a variety of other fields, including spaceflight, genetic medicine, and the various avenues of research leading toward nanotechnology. Not doing things until they're perfectly safe would be nice, but it's not realistic. There's a lot of truth in the old saw that you have to walk before you can run, and you have to crawl before you can walk. What we seem to be forgetting is that a baby making the transition from crawling to walking *always* takes some falls. One who was afraid to stand up because he couldn't face the prospect of falling would *never* learn to walk, much less run.

Our civilization, it seems to me, is in a position rather like a baby who has suddenly realized that he's standing up, and is frightened by the implications.

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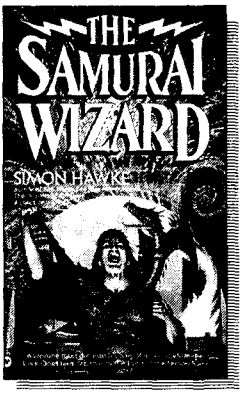

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A WORD FROM BRIAN THOMSEN

A warrior must possess many different qualities: bravery, discipline, and honor, to name a few. The mindless mass-produced martial drones of military lore who blindly obey orders and attack like uninspired killing machines are, in the long run, undesirable, and usually ineffective. For me the ideal warrior has to be an individual, respectful, and willing to follow orders, but also capable of thinking on his own, whether samurai of the past or starwolf of the future. ...and when you see me around let's not talk about war, but about fun in the future instead.

ALSO THIS MONTH:

STARWOLVES: Tactical Error
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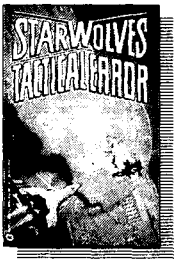

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It's a special case of a little knowledge being a dangerous thing. We've learned to do a *lot* of things that our ancestors could barely dream of; every one of us, every day, does many things which could have gotten us burned as witches 300 years ago. We've learned to do some of them so well that we *can* do them with a very high level of safety and reliability.

And we've become spoiled. We've come to think that since we can do *some* things so well and safely, we *shouldn't* do anything that we can't do equally well and safely. And therein lies a terrible pitfall. You *cannot* demand the same standards of safety and reliability from a new technology that you do from a mature one. Major advances in our abilities have *always* involved doing things that were later recognized as dangerous, and doing things ineptly is the first step toward learning to do them expertly. Our ancestors seem to have understood this better than many of us. Perhaps because they hadn't learned to do anything as reliably as we now do a few things, they took tragedy in stride as a normal part of exploring frontiers.

G. Harry Stine spoke of this here a few months back, in an "Alternate View" column called "Where Have All the Heroes Gone?" (December 1990). At its end he quoted M. Stuart Millar, owner of the Piper Aircraft Corporation—who subsequently wrote Harry a letter commenting on that column and containing another memorable quote: "No one believed we should cease Antarctic exploration because Captain Scott's group died in the effort. No one believed we should cease efforts to fly from New York to Paris because Captain Nungusser disappeared while trying. No one thought we should cease attempting to fly to Hawaii because crews were lost seeking the Dole prize. No one thought Pan American should cease Pacific flights because Captain Music's Philippine Clipper disappeared on a survey flight. That is the price of the uniqueness of the human being compared to all other terrestrial animals."

Our civilization—which shut down an entire space program for a couple of years because of one accident—badly needs to relearn that fact. *No* technology—indeed, no human activity—is absolutely safe; and new ones are inherently cruder and more dangerous than old, highly developed ones. If we allow the aggressively timid to demand that new ones meet the same standards as old ones, we can forget about playing an important role in the great adventures and opportunities for better living that lie ahead.

They're there; in space, and nanotechnology, and a host of other fields that beckon from the horizon. But getting there will involve, as it always has, risks—sometimes even unto death. Rather than using that as an excuse to huddle in the corner and fear what's outside, we should be grateful that there are those willing to take those risks—and be supportive of their efforts.

For that will always be the way to the greatest rewards. ■

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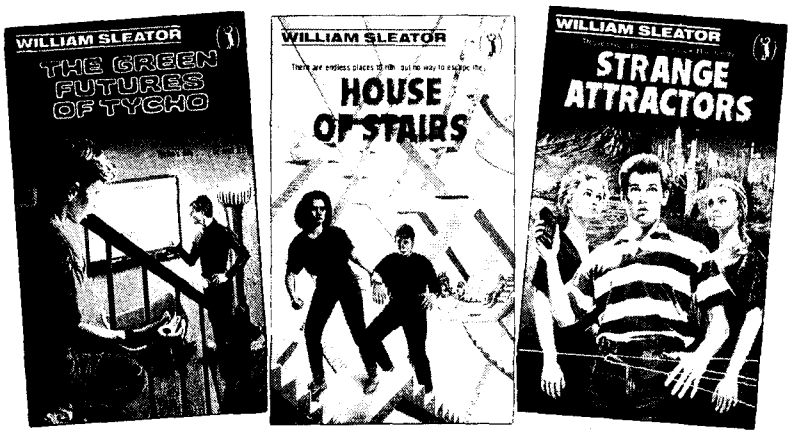

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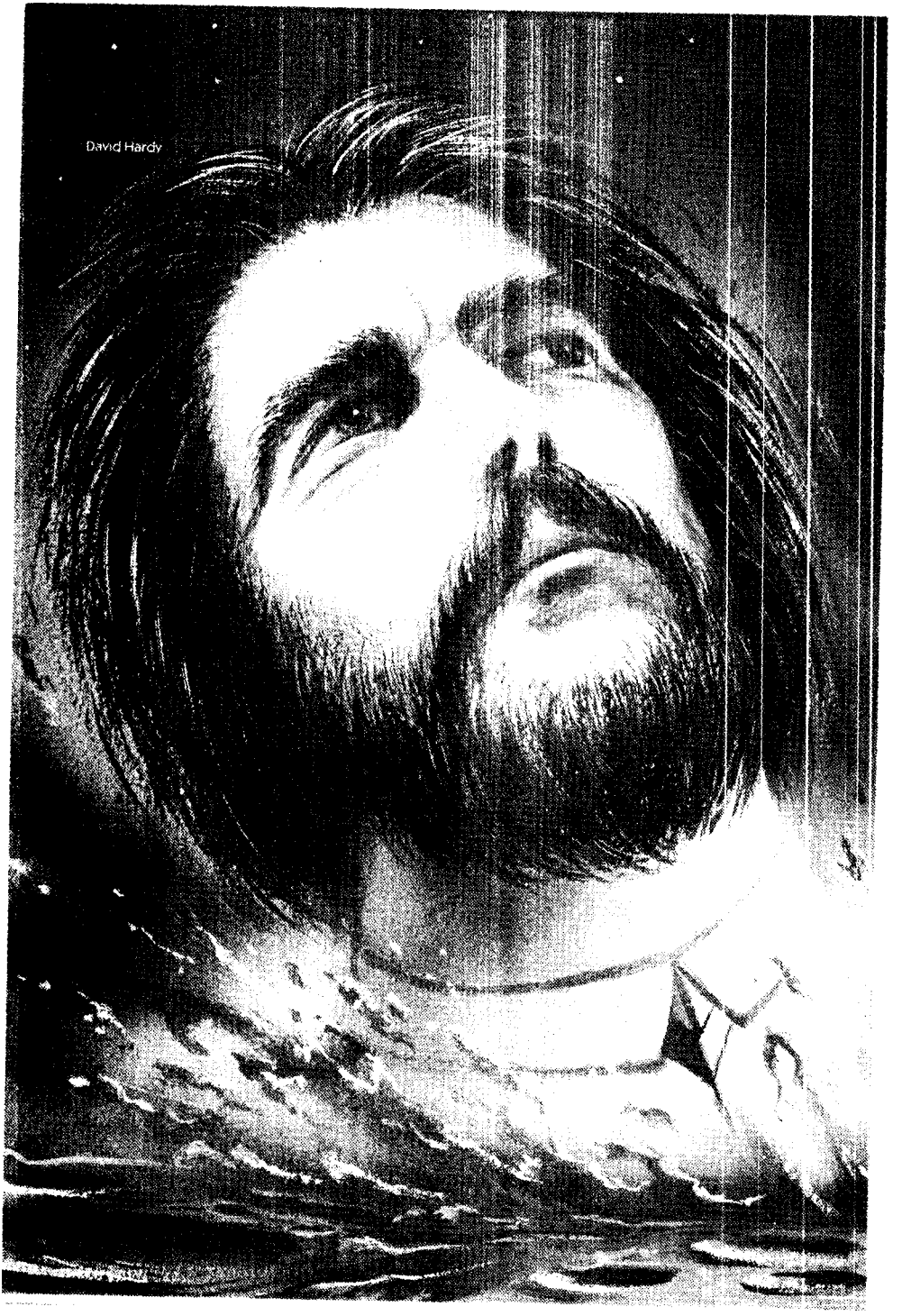

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The man in the vidscreen was dressed in rough and rugged survival gear, the kind worn under a Marssuit. But the carefully trimmed hair and beard, and a single gold earring betrayed the fact that he was accustomed to a finer wardrobe.

Assistant Engineer Ellen Brindamour recognized Winston Reed immediately—and sneered. The leader of the Green Party was probably the man most hated by everyone in the Corps of Planetary Engineers. Ellen was no exception.

The conference room was full of grey-clad senior engineers—enough of them to make her nervous. She had just entered the chamber and the sight of Reed was enough to make her halt. But as she recovered her wits, she looked for a seat at the rear of the assembly and tried to become invisible.

Reed, on the other hand, continued a speech that had begun before she arrived. The flat vidscreen and his one-sided discourse made it evident that this was a recorded message being replayed for the assembly.

"Believe me, no one is more saddened than I by the action we have taken. But for ten years, we have struggled to make the world see what it must see. For ten years, the Corps of Engineers and the General Assembly have closed their eyes to the truth.

"The Mars Project is more than a mistake—it is a crime. A colossal crime on a scale unknown in previous human history. You cannot kill an entire planetary ecostructure and escape the moral consequences.

"The leaders of the corps have insisted over and over again that Mars is a dead world. That the project will not harm any living creature. But they are wrong. If the corps is allowed to complete its program, the moral culpability of this crime will be an indelible stain on all humanity. Forever. We cannot allow this to happen. We have chosen, therefore, to demonstrate to you the true character of this action.

"That is why we have landed here in the Hellas basin to await our fate. If you choose to allow the project to continue, you will be murdering us—just as you will be murdering Mars. You can no longer evade the awful truth. Our sacrifice will stand as eternal testimony to the terrible offense that the corps and the General Assembly, through its inaction, have conspired to commit.

"We are sorry that it has come to this. But we have tried to warn you and you have not listened. Let the guilt be on your heads."

The vidscreen went blank and the room was suddenly full of angry, but subdued grumblings. She kept her own feelings to herself, but they were no less furious. Reed was an extremist. She had always thought of him as a doddering fool, out of touch with the 24th century, a throwback to a more primitive era. But if what she had heard on her way to the conference room was true, this was pure insanity.

"How many of them are there?" asked a grey-bearded senior engineer in the row in front of her.

"About fifty," said the woman to his right.

"At ground zero?"

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"Somewhere nearby. We're not sure how close."

"Close only counts in horseshoes, hand grenades, and planetary impact," quipped a young assistant engineer seated on the left.

"He's looking for an Intervention," said the platinum-haired woman, a three-striper with a humorless face.

"Fat chance," said the assistant.

Commandant Engelhart rose from his seat in the front row and turned to face the rest of the chamber. His white hair was close cut, revealing a deep widow's peak marked by a reddened scalp. His face was a map of wrinkles that resembled the desiccated surface of Mars itself.

"Engineers, this was the message we received a few hours ago from Representative Reed. He and his group are indeed in the middle of Hellas somewhere. As he explained, they are trying to stop the progress of the project. I don't have to tell you what is likely to happen to those people in forty-nine hours, when the first of the iceteroids arrives at its target.

"I don't need to remind you that you are all bound by corps discipline. That's never been necessary before today. But under these unique circumstances, I want to make it clear that your duty must take second place to your conscience. If any of you feel that you cannot carry out your responsibilities, let me know after this meeting is over."

Ellen looked around and saw nothing but defiance in the faces of the men and women in the room. None of them looked as if they were about to turn aside from their duty. They had all waited too long and worked too hard to make this day come about. Reed had underestimated the corps if he thought they would flinch in the face of his challenge.

She felt proud of her companions and proud to wear the uniform of a planetary engineer.

"Mr. Reed has been opposed to the project for a long time. He is right when he says we have not listened to his warnings. But that's not because we're blind to the impact of our actions. He is right when he says that the project will mean the end of Mars as we have known it for four centuries.

"But the new planet that will emerge in its place will be worth that price. Whether the added surcharge Mr. Reed is trying to levy makes it too costly is a decision we will each have to make on our own. I trust you to make the right choice."

Englehart nodded sharply to signify the end of the meeting and the engineers rose from their seats, heading for the exits. Ellen, however, stayed put. She had been summoned to the conference room and, so far, no one had told her why. Until now.

"Assistant Engineer Brindamour, would you come with me please?"

She turned to see a young engineer trainee, a short girl no more than twenty years old with a uniform that still shone like new, all sharp at the creases. The girl beckoned to her and the two of them made their way through the departing crowd to the front of the room.

Commandant Engelhart was waiting for her. She grew suddenly nervous in the presence of the man in charge of the Mars Project, feeling for a moment as lowly and insignificant as the trainee who had led her here. She was so over-

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come that she barely noticed the man who stood beside the commandant.

"Engineer Brindamour, this is Senior Engineer Thomas Van Horn," the commandant said. "I've got an important job for you, Engineer. You've seen the message from Reed? He sent it to us by relay from the transport that brought his party here from Earth. No chance for a reply. Not very courteous. We think we should have a chance to respond to his charges, don't you?"

"It would seem fair, sir," Ellen replied stiffly. At times like this, all the femininity in her leached away—and there was precious little of it to begin with, she thought coldly.

"Van Horn, Brindamour is one of our top pilots. And she's a good engineer to boot. If she can't find Reed, no one can."

Ellen looked at Van Horn. He was tall and rangy, with an untrimmed beard shot through with stiff white bristles and a thick head of dark, straight hair streaked liberally with grey. His eyes were deep set under a brooding brow and surrounded by a network of fine lines. She sensed something else about him as well, some kind of hidden character that simmered below the surface. She didn't know what it was, but she was sure that given time she would find out.

She was so captivated by Van Horn's sharp features and mysterious air that she only half listened to Commandant Engelhart's words. Then she realized suddenly what he'd just said.

"Sir?" She looked at him with puzzled eyes.

"Brindamour, I want you to take Engineer Van Horn out into Hellas and find Winston Reed and his party. Preferably before planetfall."

"And if not?"

"Make it back here in time, of course, Engineer," Engelhart said with a smile.

"Of course," she echoed.

Van Horn remained silent throughout the exchange, but Ellen could see the amusement dancing in his dark eyes. At her expense, too. She didn't like that.

She also didn't like the assignment she'd just been handed. In less than forty-nine hours, the first of six chunks of ice, ten kilometers in diameter, would slam into the surface of Mars at better than sixty klicks a second, blasting huge craters into the lifeless red sands.

She did not want to be out there when it happened.

A short while later, in the pilots' locker room, Ellen paused for a moment after removing her uniform and before she donned the survival gear that went on before the Marssuit. She looked at herself in the mirror on the wall, taking stock of the gentle curves and soft lines of her body. She was torn briefly between adolescent wonder at her own femininity and bitter anger at the necessities of adult life that made her deny her sexuality.

But those feelings were an indulgence she could not afford right now. As she had so many times since deciding to join the corps, she supressed them and got on with the job at hand.

Besides, there was another nagging thought that interfered with her private recriminations. Who was Van Horn?

When she was at the Academy, under the dome at Alphonsus City, the other

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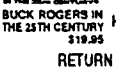
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cadet engineers had claimed she used the corps register as a nightlight. They were not far from the truth. Ellen had studied the list of the senior engineers whose awesome task was no less than the remaking of the Solar System. She knew their names, recognized their faces, studied their biographies and had even read their articles and papers. She was determined to emulate them all, rising to the highest levels of the corps, and she knew that the only way to accomplish that was to learn all she could about how they had gotten there.

So she knew right away that Van Horn was not one of the engineers assigned to the Mars Project.

And with that in mind, she could not figure out what he was doing on Mars. Where had he come from on such short notice? It had been a month since the colonists had been transferred to the impact shelters and the last of the scientists and technicians had left the red planet. The corps only maintained one base on Mars, here in the Bunker. Van Horn must have come down from Phobos or even further—Luna or Earth. But why? What was his assignment? And why was he chosen to seek out Reed and his followers?

There were no easy answers to Ellen's questions, and she wasn't sure how to find the difficult ones. Somehow, things didn't add up. And when that happened, it made her very uncomfortable.

More so, even, than flying into the middle of a thousand-kilometer-wide dustbowl less than two days before icefall.

She tightened the straps on the Marssuit and tested the breather. The telltales in the helmet display indicated that all systems were operating normally. Then she pulled off the helmet, tucked it under her arm and headed towards the hangar.

She ran into Engineer Forester on her way through the flight ops center.

"Goodwatch, Assistant Engineer Brindamour," he said with a condescending leer. "I see you're suiting up for a flight. Isn't it a little close to planetfall to be taking an excursion?"

Forester was arrogant, stupid, and, worst of all, a year senior to Ellen. Any day she could avoid running into him she counted as an extra week added to her life. Today, she felt the cold hand of her own mortality creep measurably closer.

"Special duty, Engineer Forester," she replied testily. "Orders from the commandant."

He narrowed his eyes and tilted his head mockingly. "And how did we draw that mission, I wonder?"

"I guess some of us are just better pilots than others," she said with a smile.

She knew her response was just insubordinate enough to warrant a reprimand, but Forester was so close to her in rank and status that she could get away with it. Ordinarily, the corps was a tightly bound organization with strict protocols on the relations between senior and junior officers. The pressures of Earth's crowded societies were not lessened in the confined habitats of space, even though the numbers were reduced—and that meant a rigorous pecking order and highly formal customs.

Added to that was the way the corps clung to an older day of male domi-

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nance. Back home on Earth, the last few decades had seen a wave of femininist resurgence as a handful of strong women leaders arose to integrate the disparate cultures of the homeworld. But the corps was still mired in the past.

To Ellen it was just another obstacle to be overcome, and a familiar one at that. Her brother had treated her no differently than Forester, and she had managed to live with that burden. In fact, she had learned how to deal with the bullying abuse of the male engineers long before she joined the corps through the long suffering of her childhood.

Forester was obviously an Only Child. They were always so self-assured and so self-centered. Just like her brother.

His sneer turned into a frown. Ellen was sure he was getting ready to rebuke her for her insolence. But she was ready for him.

"Of course, if you want to volunteer, I'd be happy to stand aside."

The steam went out of his boilers and he backed off. "No need, Engineer. Carry on."

When he was out of sight, she allowed herself a devilish smile, then she continued on her way to the weather globe.

The three-meter-high orange and grey hologram circled slowly in the middle of the compartment. Areosynchronous satellites provided a real-time view of the Martian atmosphere. Faint wisps of white clung to the peaks of Olympus Mons and Tharsis Ridge, and a peach-colored haze filled a quarter of the southern hemisphere.

Ellen adjusted a control and the globe was covered with traditional weather symbols—isobars, H's and L's and wind vectors. It was midsummer in southern Mars, the warmest part of the year. Noontime temperatures were a balmy 270 degrees Kelvin—not quite enough for liquid water, if there were atmosphere enough to hold it together. At a touch of the control, the patterns were set in motion, a loop of the last day and predictions for the next.

The air circulation on Mars was similar to Earth's but not identical. Where terrestrial weather was marked by Hadley cells at the equator—with warm air rising and cool air descending to the north and south—the hottest regions of Mars were in the south, and the Hadley cell centered there covered more than half the planet. The warm atmosphere rose in the south and descended again far to the north. Beyond that northern trade wind were the usual storm-filled westerlies.

But the storms, like the winds, were nothing like the gales of Earth. With an atmospheric pressure that rarely topped four millibars, they were truly nothing more than ghost storms and spirit winds. Indeed, the atmosphere was so thin, that conventional convection could not work. The everpresent dust of the Martian surface was needed for that. The dust absorbed enough solar radiation to get the atmospheric heat engine working. When it was at its peak, the whole planet would be covered with clouds of the thin ochre dust for weeks.

Ellen touched another control and framed Hellas Planitia, a yellow oval gouged from the cratered highlands of the southern hemisphere. A bit to the west was the puckering scar of Argyre. Hellas was the lowest point on the Martian surface, hammered there by the last

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of the large planetesimals in what was known throughout the Solar System as the Late Heavy Bombardment.

A panel appeared in the air between Ellen and the globe, depicting a close-up view of Hellas. A heat low was forming over the west end of the basin, and dust was boiling up out of its vast, wind-blown depths.

Out there in the middle of Hellas, in a few hours, the ice would hit. When that happened, weather would never be the same again on the old red planet. . . .

Until then, however, visibility was going to be lousy over the basin. Rotten luck. She hated flying in dust. She had to rely too much on the instruments and always ended up with her body twisted up in a knot over the controls, and a backache that wouldn't go away for a week.

She picked up her helmet and continued on to the hangar. The sound of her boots slapping onto the concrete echoed from the high ceiling overhead as she bounded low-gee-style across the floor. On the far side, centered before the lock door, was the boat.

It stood five meters high and ten long, with a glassy cockpit perched behind a blunt nose. There was streamlining, but not much. Airfoils, but mainly out of a sense of obligation instead of need. And there were the external work platforms running the length of the thing on either side that gave it the look of a boat more than an aircraft. Right out of Barsoom or Buck Rogers, she thought.

The next generation of Marsboats would have to be different, of course. More streamlining and airfoils that worked, to begin with. And they could get rid of the outside decks, too.

She was atop the boat in one leap, then she worked her way aft down the starboard deck, inspecting the equipment mounts, the safety plugs, the emergency beacons, running lights. She did the same up the port side, then clambered atop the central fuselage.

She was still there when Van Horn entered the hangar. She noticed him right away because of the awkward and unsteady way he maneuvered across the large empty space. He wasn't used to Martian gravity, she could tell. Fresh up from Earth for sure. It took him a few minutes and nearly a broken ankle to get to the boat.

"Goodwatch, Senior Engineer," Ellen said when he looked up at her and saluted. She couldn't for the life of her figure out what the salute was for.

"What are you doing, Engineer Brindamour?"

"Preflight inspection, sir."

"Don't they have computers to do that?"

"Yes, sir. But there are some things you just don't leave to them.

"What's that you're inspecting now?"

"The paravane, sir. If we lose power while we're aloft, this will let us set down in something resembling one piece."

Van Horn coughed and turned his head away, hiding his expression from her briefly. She completed her check of the release mechanisms and the safety switches, then dropped in two steps to the ground. "This way, sir," she said as she escorted Van Horn through the airlock and inside the boat.

The passageway through the center of the craft was narrow and cramped.

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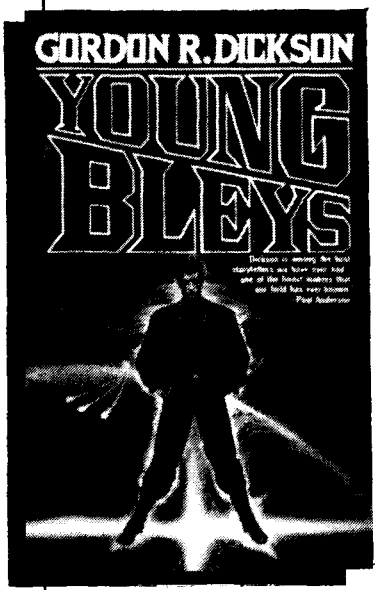

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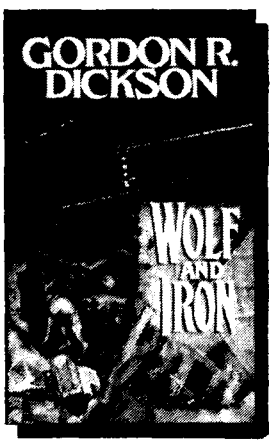

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Ellen had to catch her weight on an overhead bar and swing herself into the cockpit. Van Horn tried to duplicate the trick, but misjudged the timing and bonked his head against the bar.

She studiously ignored his embarrassment as she settled into the pilot's seat. He slid into the seat beside hers and allowed her to adjust the straps on his safety harness.

It took a few more minutes to complete the preflight inspection, interrogating the computers and wading through the rapid-fire data displays they presented in response. When she was satisfied that the craft was Marsworthy, she signaled the control center, then turned on the power.

Behind them, a trio of thrusters began to hum—each unit consisted of a tiny loop of cosmic string and a thrust bar mounted in heavy, load-bearing gimbals. At a touch of her hand on the control stick, the bars inched into the loops and the pseudo-gravity of the twisted space within pulled at them—and the Marsboat with them.

She lifted the boat a few centimeters off the floor and nudged it into the airlock. A single steel door slid down behind them, the hiss of escaping air slid along the hull, then a second steel door rose before them. A ruddy, dusty landscape was revealed by the rising gate. High, rocky mountains stretching away to the north, layer behind layer, given enhanced perspective by the peach-colored haze. Visibility was lower than normal, Ellen noticed. She couldn't even see as far as Savin Rock, a large outcrop that marked the northern horizon.

"Hang on, sir," she warned as she goosed the throttle. She was thrown back in her seat as the thrust bars dipped deeply into their sockets. A moment later, they were a kilometer above the surface, and Ellen was banking into a tight spiral over the Bunker. She looked past Van Horn at the jumble of glass domes, pressure walls, greenhouses, and antenna disks that seemed to tilt precariously on the rocky surface. Then she straightened out and steadied up on course for the center of Hellas Planitia.

"There—that should get us there in a few minutes," she said after programming the piloting computer.

Van Horn looked pale. For a moment, Ellen grew concerned. Surely the senior engineer was not about to lose his breakfast before they reached the edge of the basin. She relaxed when he managed a lame smile.

For the next few minutes, they rode along in awkward silence. By corps tradition, it was up to Van Horn to initiate the conversation. Ellen paid him the deference he was due and tried to look busy while the computers handled the boat.

Somehow, though, she felt terribly self-conscious. She felt as if Van Horn was studying her every motion, recording it, analyzing it, judging it. If he wanted to talk to her, why didn't he say something?

She wondered with a sudden blush if there might be something sexual behind the tension. Did the senior engineer see her as attractive? She certainly thought he was handsome, though she hadn't considered that fact on a personal level yet. She was briefly aware of the closeness of their bodies in the tight cabin, his wide shoulders and penetrat-

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ing eyes. A brief reflection and a sudden fluttering of her heartbeat suggested a possibility worth exploring, but she set that idea aside.

"So tell me, Engineer Brindamour," he said after a while without warning, "what kind of a family did you come from?"

The question caught Ellen off guard. It was not the kind of thing senior engineers asked assistant engineers. Shop talk, usually as technical as possible, was more what she had expected. She'd hoped to ask him which project he had departed so recently. Though it was a risky gambit to try and put a senior officer on the spot like that, she had done it before. But not this time. A personal question. Was this some kind of new test?

For three centuries, the number of candidates applying to the Corps of Planetary Engineers outnumbered the billets a thousand to one. There was no end to the competition outside or inside the service. It was the duty of all officers to constantly measure the men and women who worked for them. That was a fact of life that had set the tone for a long tradition of formality and rigid protocol between different levels of rank—and a cutthroat attitude towards one's peers.

Van Horn had cut right past that whole tradition in one sudden stroke. Ellen was so surprised that she didn't think twice before answering.

"My brother was an Only Child. I came along ten years later. He never missed a chance to remind me how much he resented the fact. It bumped my parents from a condo on the Ringside to one on the Outside—in a sector full of breeders."

She hesitated before continuing. It might not be wise to reveal too much, but she decided to be honest and forthright. Treat her own life as dispassionately as dropping millions of tonnes of ice on Mars. That ought to impress him. "My parents let him get away with it. They were strict, withdrawn. I decided the only way I was ever going to prove my brother wrong was to do everything better than anyone else. I worked hard and disciplined myself. I still do."

"And your brother?"

"He's an actuarial scientist. He's got an Only of his own and a Ringside condo. I write to him on his birthday. He faxes me a card on mine."

"Did you ever thank him for getting you so far in life?"

"Thank him?"

"I thought you said he was responsible."

"I did. But I didn't mean it like—"

She realized quickly that Van Horn was joking with her. She had been looking away from the man, not wanting to lock eyes while she spoke about herself. Now she saw that a broad grin had sprouted from his salt-and-pepper whiskers. For a moment she became disoriented. Van Horn seemed like just an ordinary human being instead of a senior engineer. She felt as if she were talking with an old friend, an acquaintance outside the corps.

"I know," he said. "I apologize for teasing you. But you have to admit you have come a long way. Mars is certainly a long way for me. It looks like Arizona without the cactus."

Ellen looked at him quizzically, then

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shook her head. He was a peculiar kind of engineer indeed.

"That's the first time I've heard it described quite that way," she said.

"It'll all be different in a few days, won't it?"

"Very."

"Tell me something, Engineer Brindamour, what do you see here on Mars in a thousand years?"

Another odd question from a senior engineer. "Paradise, what else? An ocean in the north, balmy seas in the south. Snows on Olympus Mons and Tharsis Ridge. Thunderstorms across Vallis Marineris. Rainbows. Blue skies. Palm trees and birds."

"Arizona with the cactus."

"Yes, I suppose so—at first."

"And what will you do when the ice has fallen and the project is completed?"

She had fallen completely under Van Horn's strange spell. Ordinarily, she would never have exposed herself like this. Junior engineers were not supposed to have ambitions. They were supposed to pretend to be selfless automatons, ready to gladly go wherever they were instructed. A few even managed to convince themselves of that myth. Ellen Brindamour was not one of them.

"Ganymede. That's the next step for Mars. We have a chance to move it within the next ten years—if we work hard enough. It'll help stabilize Mars in its orbit. Make sure that all this work doesn't go for nothing. And it'll look very nice in the Martian sky—better than those little fireflys they try to pass off here as moons."

"Quite a plan," Van Horn said. "Is that all?"

Ellen recovered her wits enough to try to generalize her way out of jeopardy—in case Van Horn was setting some kind of elaborate trap. "Pump hydrogen to Venus. Bring Mercury out from the Sun. There's plenty of work to be done wherever the corps is."

She felt her face flush with warmth as self-consciousness replaced intimacy. With a sudden flash of fear, she turned back to the piloting computers. She was glad to see that they were already nearing the initial point for their search pattern.

"But first there's work to be done right here," she said. "And I'm afraid it starts now. . . . "

Hellas stretched below them for hundreds upon hundreds of kilometers, cloaked in yellow-red dust, featureless and empty. On the Moon or Earth, the huge planetesimal that formed the basin would have broken through thin crust to release upwelling lava. But Mars had a crust so thick that the impact left only a glancing scar, a huge bowl devoid of detail.

To Ellen Brindamour, it was worse than flying across an ocean. There were no reference points—just an indistinct horizon that marked the soft transition from dusty to dust-free sky. She put her faith in the piloting computers and devoted her attention to the sensors.

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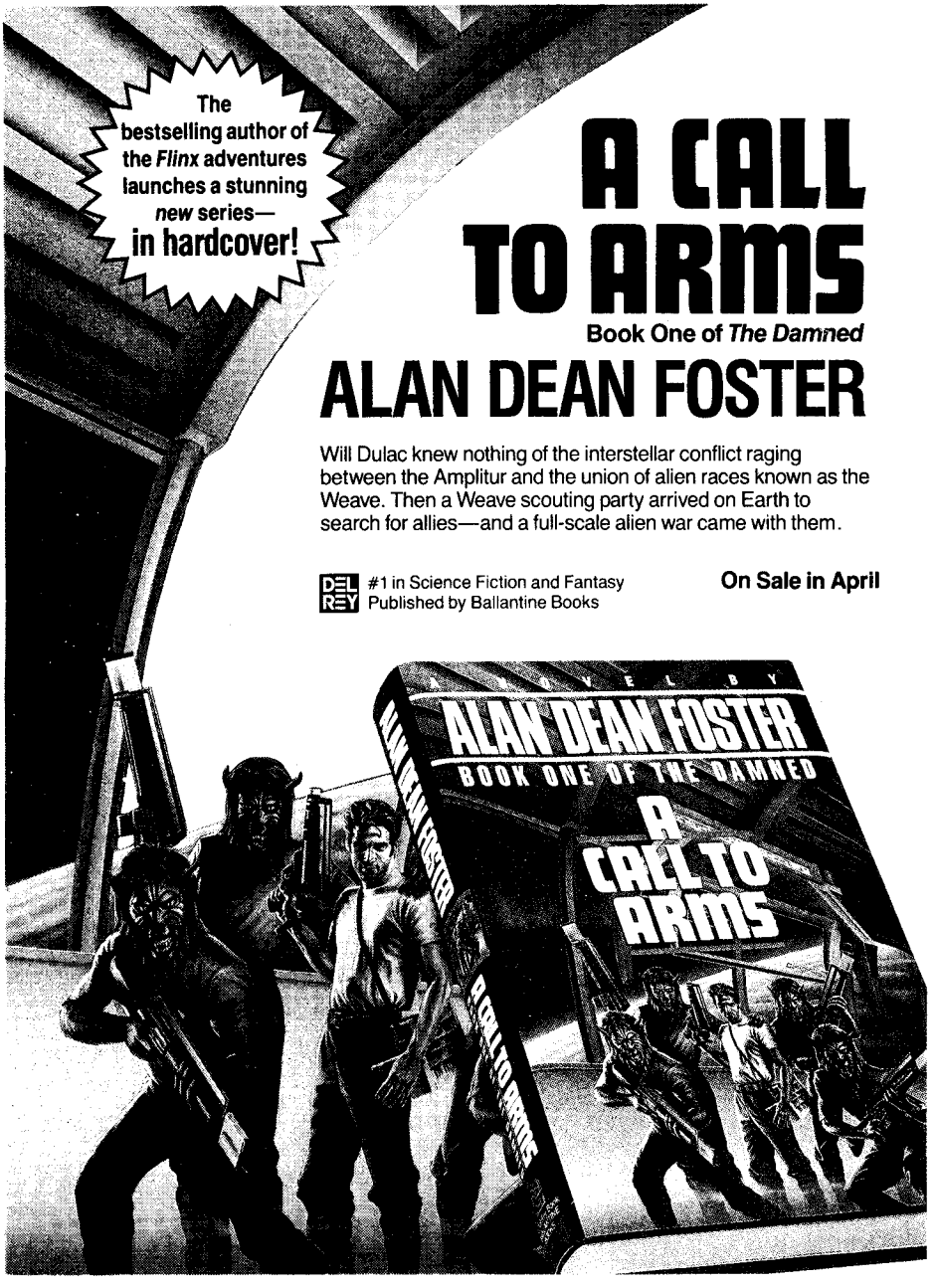

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sort of thing you needed to find a spaceship in a dustbowl.

Except that after an hour's rapid search, they had discovered nothing.

The pattern had been a broad one, she had to admit. They'd been clipping along at Mach 10 at an altitude of ten kilometers above Mars Mean Level —fourteen klicks above the bottom of the basin. You'd think that something would show up—the power plant, the metal in the hull, the hot engines—but there was nothing.

At least Van Horn kept to himself—probably frightened off by her intense involvement in the equipment, punctuated by restrained profanity that she bit back through clenched teeth. When the computer integrations didn't give her what she wanted, she switched over to raw data feeds, trying to make sense out of the spikes and blips that the data processing edited out.

Even that didn't work.

Another hour passed while she tightened the search pattern, slowed the boat and sifted the data byte by byte. By then, Van Horn could no longer contain himself, but by then his interruption was a welcome relief from the concentrated effort of jiggling details of the surface from the dancing electrons of the sensors.

"No luck?" he asked softly.

"Not luck. Just me. If I were better at this, I could make these things tell me what I want."

"What have you got?"

"Dirt. Or dust. A lousy map of the surface of the basin to start with and not much more to add to it. There isn't much down there. Salt flats in the middle, a few late craters, mostly smooth rocky plains. A stick in the ground should show up on my sensors."

She plugged the vidscreen into her datamap, dialed up a few details.

"That's what's down there?" he asked.

"You can see the craters. We just spent an hour running from one to another, looking in the cracks. There's a large network of graben around the salt-flats where the crust subsided during the Water Age, but none of them are deep enough to hide an orbital shuttle."

"And the three stars in the middle of the map?"

"They're the old Space Corps Mars Bases. They must be two hundred years old. Not much there—they just make a big mark on the surface scan. Old domes and stuff."

"The kind of place ready-made for an overnight camp out by the Greens?"

Ellen felt her face burn, hoping momentarily that she could hide her embarrassment from Van Horn. His suggestion was so obvious, yet she had never considered it.

"I suppose so," she said dubiously. "Of course, it'd be the first place to look. Not good for prolonged concealment."

"Maybe they don't expect us to come looking. . . ."

The first base was empty, as it had been for decades.

The broken remnants stood as silent monuments to an earlier age, when the planet had been the subject of boundless explorations. Ellen felt a small pang of guilt at the loss of even these worthless shards of human remains. Mars had seemed so big and mysterious back

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then, large enough to swallow explorers without a trace. Now it seemed so small and handy, so easily manipulated. But she felt no sense of loss at the changes that would come in the next few days. New explorers would take the place of those long gone—and their discoveries would be greater than any of those earlier expeditions.

Sand filled the masonry greenhouse foundations and piled against the high concrete domes. Empty streets and landing fields had blended back into the surrounding barrens. The dusty sky muted the light, erased the shadows. Ellen couldn't get any sense of scale for the place—not until she nearly flew into one of the domes.

From the cockpit they could see that nothing had disturbed this place for years. The Engineer Corps hadn't even bothered with it during the last year's evacuations. The place had been stripped clean a century ago.

She traded disappointed frowns with Van Horn and set in a course for the next base.

That was a different story.

She could see the gaping hole in the dome from several klicks out. A ragged tear had split through the concrete and half the roof had caved in. The accident must have happened long ago, because the rubble had been cleaned up and passages cleared through into the interior.

As they came closer, the computer began chiming for attention. She slipped it from inactive search to active search and lights began flashing across the windows in front of her.

A metal hull! Engine radiations! Low-power VHF!

"We've got them!" she exclaimed.

"Take us down there," Van Horn ordered.

"What?"

"Can you land up close to the dome? I'd rather not have to waste time walking."

"Land? I thought we were just supposed to find them." She realized that her voice had acquired a sudden panicky edge and she tried to bring it under control. "I'm sorry, sir. I just wasn't clear on what we were doing out here. Is that clear patch in front of the main entrance close enough?"

"My fault, Engineer. I assumed you knew that I wanted to talk to Reed."

She swallowed hard. This was not at all what she had expected. Why would a senior engineer waste his time swapping air with a moonbeam like Reed? Now Van Horn's eccentricities took on a more ominous overtone. Who was this man and what was he up to? He didn't sound like a rational engineer. Did the other project leaders know what he was up to? A foolish question—they must know.

And how was she going to be involved? She realized that more was going on here than she had first believed, but she didn't know what. The uncertainty was enough to tie her stomach in knots.

"That clear spot is fine, Brindamour," Van Horn said.

A moment later they were on the ground, and a moment after that, the boat was surrounded by a small crowd of genderless figures wearing Marssuits.

Ellen bounced nervously from window to window, trying to get a good

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look at the crowd. There were about forty of them, and she wanted to see if any of them were carrying weapons. Or nearly as bad, tools or clubs that could damage the boat.

Van Horn seemed unaffected by the reception and was rummaging around for something.

"Can I help you, sir?" she asked.

"My helmet," he said. "I've misplaced it."

She retrieved it from the compartment behind the seat where she'd stashed it before takeoff, but she didn't hand it over immediately.

"Are you going to go out there?"

"Certainly, Brindamour. And you're coming with me."

She bristled at that. The time had come for some straight talk, no matter how senior an engineer Van Horn might be. "Sir, could you explain what your plan is? I mean in detail."

He smiled again, bunching up wrinkles around his eyes. She noticed briefly how thick the white bristles grew in an otherwise dark beard. "I'm going to find Winston Reed and talk some sense into him, Brindamour. Maybe we can save a few people's lives today."

As she stared at Van Horn in disbelief, a handful of stray thoughts and speculations that she'd been collecting on his origins suddenly came together.

Van Horn was obviously unbalanced—a laptop jockey who'd spent his life in a cubicle on Hawaii instead of out here where the work was done, Ellen judged. The years must have gotten to him, made him think he was more important than he really was. With the right connections at Pearl Harbor, he could have wangled a flight to Mars.

But to Ellen, his last remark revealed his motive. He reminded her so much of her brother. He was so sure of himself and his own righteousness that he had to set everyone in the world straight. A self-appointed world saver—just like Reed. The two were perfectly matched. Between the two of them the world's problems were all but solved.

She had been a victim of that kind of arrogant criticism for years and now she was going to become a victim once again.

"Are you sure it's wise to leave the boat with them out there?"

"Them? Don't worry—they're harmless. These are Greens, Brindamour. Not too many aggressive types in the bunch. 'Tree huggers' is the term used on Earth. Entirely verbal—nothing physical."

"If you say so, sir. But this boat is the only way we can get out of Hellas."

"And you don't want to lose your ride? I don't blame you. But I've dealt with these people before. You really have nothing to fear."

She looked into his eyes and felt puzzled. There was nothing false about his sincerity. He didn't look wild-eyed or crazed. She was almost convinced that he was right.

And she certainly didn't want him to think she was afraid. . . .

Ellen stood on the deck of the boat and looked down at the Greenies. They pressed up against the hull, but their attention was on her, not the craft. She could tell they were agitated. Some waved their hands and shook their fists, others rocked with a rhythmic beat to some unheard chant, all in eerie silence,

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the Martian air too thin to carry the sound.

Finding the channel the Greenies were using for suit talk was easy—it blared with overlapping signals as everyone yelled at once. There was no communications discipline, no call signals, just shouting.

"Stop the ice! Stop the ice!"

"Go back to Earth!"

"Murderers!"

She could see the faces of Reed's followers through the helmets now that they were closer. Men and women both, some with features twisted around angry words, others with distant staring eyes and silent mouths. She switched off the main channel and went looking for calmer voices—and the animated tableau of the protesters fell silent once more.

"—on my way there, Mark. Just try to keep everyone calm."

The voice cut through the phones as Ellen hit a busy channel. She recognized it as Reed's. There was no doubting its clear, penetrating tones. His skill with words had given him his power. She looked at his followers and saw that their Marssuits were all brand new. To the rear of the dome, hidden in dusty shadows, was a small camp of inflatable tents, all equally recent purchases.

The Greens were making it an expensive suicide.

Then a figure emerged from the camp and crossed the distance to the Marsboat in a series of low, kangaroolike bounds—the mark of a newcomer to the planet. Ellen could see from a distance that the man's helmet was marked with three white stripes that the others lacked.

His final bound carried him to within a few meters of the boat, and he shuffled the rest of the distance to the hull with the assistance of his loyalists. Van Horn tapped her on the shoulder and put up his hand—first three fingers, then all five.

When she switched to channel 35, she heard them talking.

"—sorry about the way you were greeted, Senior Engineer Van Horn. We didn't expect you to arrive today. Come on down and let me show you our better hospitality."

"If your people will back off from the boat, we'd be happy to, Mr. Reed," Van Horn said. "My pilot here says there are some toxic chemicals and radiation hot points back there where the tall fellow is standing. She's terribly nervous about one of you hurting yourselves on her vessel."

"Certainly," Reed said. He patted one of his aides on the back and pointed to the crowd, then waved an arm back to the camp. Within a minute the protesters had fallen back, some leaping high over their comrades in their haste to depart.

With the crowd dispersed, Van Horn turned to Ellen and grinned, then bowed and extended an arm to allow her to disembark first. She remained motionless, however, and waited. "The senior officer is the last to board and the first to depart, sir."

"Of course," Van Horn said. He hopped off the deck and dropped slowly to the ground.

Of course, Ellen thought. He should have known that. There were some rules you learned early and never forgot and that was one of them. He should have known that. Who was he? Despite her

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earlier speculations, the question remained unanswered.

The first thing Ellen Brindamour noticed once they were inside the tent was Reed's face. These were not the features that she had seen only a few hours earlier in the conference room. Reed did not look well—his eyes were red and rimmed with wrinkled flesh, his cheeks were drawn, his complexion pale and ashen, his hair coarse and uncombed, and a muscle in his left temple twitched.

They must have used computer dubbing to disguise Reed's true appearance. The aging politician before her actually looked like the leader of a band of martyrs about to be devoured by lions and not some computer-generated phony.

But his voice was untouched by the stress—if you discounted the hoarse edge that slipped through now and then. He still could command attention by the timbre and tone of that voice. He used it now like a shepherd's crook, directing them as they filed into the main chamber of the tent.

"This is my chief aide, Mark Osgood," Reed said when they were all inside. Osgood was a young man with perfect features and sharp eyes. And, in sharp contrast to his leader, he was alert and quick to respond to Reed's requests. Ellen wondered what such an obviously bright young man would have to do with an extremist like Reed.

"Mark, have a seat on the couch. Mr. Van Horn, come up and sit here with me. You too, Miss Brindamour. David and Julie, could you take care of their equipment?"

Julie reached for Ellen's helmet, but Ellen was quicker. She glared at the woman and held the glass bowl tightly. Van Horn was not as careful, however. Ellen felt her stomach tie itself in a knot as one of the Greenies walked off with the engineer's helmet.

Reed continued his monologue almost without pausing for breath, never once showing that he noticed his assistant's deft misappropriation.

"Again, let me apologize for the way the rest of the party behaved upon your arrival. I'm afraid their feelings are running a little strong, and they didn't take time to realize that you're just trying to do a job. I don't blame you, of course. It's not your fault. This all began such a long time ago, didn't it? The decisions have long outlived the men and women who made them.

"Perhaps you can see some of my argument, though. This truly is a tragedy of monumental proportions. Look around you—this is the legacy that our generation has inherited. The search for knowledge has been abandoned to the search for wealth and power. This ruined base is proof of that."

Ellen was more conscious of the stark, raw interior of the tent, the rough fabric and rudimentary furniture. If you were only going to be using it for a few days, it probably didn't matter what it looked like, she decided, but it seemed like a terrible place to end your life.

"But there's more to this than you realize. The destruction of the Martian environment is only part of a larger threat—a threat to all of humanity. You see, the evil that is hidden in this event is the false promise it extends to our race. If you are allowed to carry out your plans, you will fool the people of the world into believing that there is

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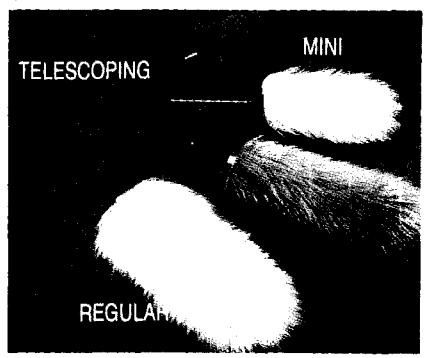

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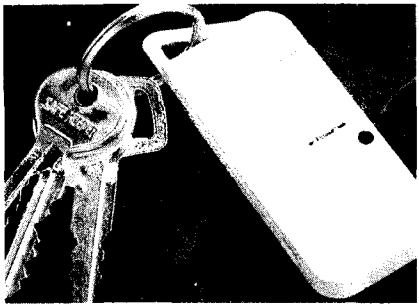

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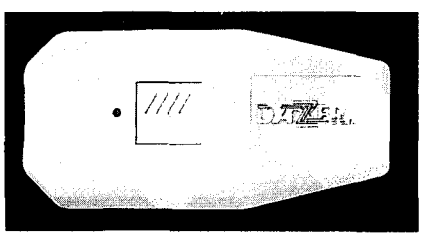

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room in the Universe for their unlimited growth. They will no longer be restrained, no longer feel any reason for self-control. They will return to the wasteful ways of the past.

"And worst of all, they will not accept our solution to the terrible state the world finds itself in today."

"You mean negative growth?" Van Horn said, slipping the question in when Reed paused to inhale.

"Exactly," Reed said. "How long can the world survive with a population of ten billion souls? That's twice its carrying capacity and four times what a stable society should contain. How much longer can we hold off terrible disasters? The arcologies are an intrusive and unnatural environment for mankind, yet three-quarters of the world lives within them. The planetary heat-trap is so delicately balanced by the sun-screens, and the skies are so thick with factories, steel mills and weather stations. The only hope for Earth is to remove the excess population quickly and drastically—in a few generations. Make Only Children mandatory. There is no hope with a program like that as long as it is voluntary."

Ellen drew back as the fire returned to Reed's tired eyes. The energy that moved him seemed unnatural, like a lighting tube just before it starts to burn out.

"Of course you see that, don't you? There is no other way. What you are doing is wrong. You must be stopped. That's why we've asked for an Intervenor. But still, we bear no malice to you personally. This is a larger struggle than that."

Van Horn nodded, but Ellen was squirming inside. She tried bravely to conceal her fears, but she did not fool herself. Her fate was in the hands of two men who had lost their powers of rational judgment and time was quickly running out.

"And now that you are here, there is even more reason for them to honor my request for an Intervenor," Reed said with a sly smile that his gaunt features turned wicked.

That was all Ellen needed. Her worst fears were confirmed.

Van Horn seemed to pick up on the vague threat quickly enough. "Are you implying that you want to make us your hostages?"

"Not yet." Reed said. "There's no need for that yet. Maybe it won't be necessary. But please stay as our guests for a while—before that decision has to be made."

Ellen cringed as Van Horn drew his breath and began to speak. What kind of trouble was he going to get them into?

"I'm afraid you're laboring under an illusion, Mr. Reed. I don't think anything is going to change what the Planetary Engineering Corps has already set in motion. In a couple of days, the name of this place will be shortened from Hellas to Hell—literally.

"Just as scheduled, six ice asteroids will impact in the center of the basin. The energy of the impact will vaporize the ice instantly, and superheated steam will rip through the thick vacuum that Mars passes off as an atmosphere. The first shock wave will tear this base from the rock—and everything with it."

His voice was calm and certain, and Ellen was once again puzzled by the lack of crazed mania that she expected

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from Van Horn. He sounded so rational, but what in the world could ever lead him to believe that he could change the mind of a man like Winston Reed?

"Make no mistake, Mr. Reed—this will happen."

"I'm sorry for both of you if it does," Reed said. He frowned, then turned away as he and his aides left the room.

"Mandatory Only Children?" Ellen said when Reed and his compatriots were gone. "What does he think he can do? Look at the way they are now with all the pressure for two. Onlies are just half of the families in East America—not even that in India and Africa. People aren't going to let him tell them how many kids to have."

"Probably not," Van Horn said absentmindedly. "Do you think they locked the door?"

"No need to—they took your helmet."

"Is that where it went? Never mind. They'll bring it back before long."

"What makes you so sure of that? If you don't mind me asking, sir," she said. Her nerves were overcoming her good sense and usual discipline. But there was something about Van Horn that made her feel she could lower her guard and express her feelings—and not worry about the consequences. "Do you think he's going to get an Intervenor?"

"I told him what I think. Planetfall will go ahead as scheduled."

"That's not very reassuring right at the moment. Especially with us out here."

"Don't worry about us, Brindamour. We'll be all right, believe me."

She looked sideways at him, but didn't voice her doubts. She changed the subject quickly.

"Actually, the whole idea of an Intervention gives me the creeps."

"And why is that?" Van Horn asked.

"I don't like the idea of Intervenors going around manipulating society, fixing things up in secret. How is anyone supposed to know what they're doing? How do we know they're not making things worse?"

"Actually Intervention is always a public act, and there's always a public record. Look at the Iceland Cod War back in '43 or the Luna City strike last year. There wasn't anything secret about those Interventions."

"Yes, but how many others have there been that we don't know about?"

"That's a question that can't be answered."

"And that's what gives me the creeps."

Van Horn held up his hands helplessly in logical defeat. "All I can say is that Intervenors aren't supposed to act unless it's necessary—and they're never supposed to do more than they absolutely have to. Human Science is more susceptible to observer effect than any other discipline."

"Observer effect?"

"The problems associated with trying to measure the size of soap bubbles by touch. The observer can do more to influence the observations than the process you're trying to observe."

"That's supposed to be reassuring too?"

The man had no answer.

Reed returned after a long time—nearly half an hour, though it seemed

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like a year to Ellen. He was beside himself with excitement when he entered the room.

"We've already received a reply from the Bunker, Engineer Van Horn. They're quite concerned about your safety, although I really can't see why. We are not going to harm you. And if the Intervenor arrives, then none of us will have anything to worry about."

Ellen felt her insides turn to water as she realized what Reed was trying to do. They were already hostages, and the corps knew it. But that wouldn't be enough to stop the ice from falling.

Then her fear was sharpened a hundredfold as Van Horn rose from his seat and approached Reed. She knew this had been coming and now here it was. Sooner or later, Van Horn had to start an argument with the man. After all, that was what he had come here for.

"That's not going to work, Reed," he said. "Are you really going to use force to keep us from returning to the boat? You're a man of principle. Do you really believe your principles can withstand that kind of contamination with the strictly practical? Force in the abstract is one thing—like when you talk about restricting the birth rate. But this is force in the real world."

Ellen watched as Reed's hollow eyes wavered under Van Horn's attack. Even as she feared for her life, she admired the depth of his argument. He was amazingly perceptive for a senior engineer. . . .

"When we are ready to leave, we will walk out the door and we will leave."

Reed looked puzzled, unprepared for Van Horn's defiance. "And when will that be?" he asked meekly.

"When we have finished our business with you, Mr. Reed."

Ellen watched strained emotions flash across Reed's face. Obviously the politician was accustomed to less direct confrontations. She certainly was. And this one was enough to tie her in knots. She clenched her teeth and twisted her hands inside her gloves as she watched Van Horn dance along the knife edge with their fate hanging from his every word.

This was not normal behavior for any kind of engineer, she realized. She could imagine a deskbound number cruncher—as she imagined Van Horn to be—loosening his collar and making indiscreet remarks about Reed's ancestry. But openly denouncing the man in critical detail was beyond the limits of the corps' phlegmatic membership.

"And what about you, Engineer Brindamour? Are you ready to leave yet?"

Reed caught her off guard. Her mind raced, but the words of a reply jammed up in her throat. All her doubts about Van Horn flooded to the surface. She wanted to tell someone, warn them that he was unbalanced, irrational or something else. Something else, but what?

She looked at Van Horn and his eyes locked with hers. There was something pleading in them, asking her for something. But she could not sort out what. It only made her more confused, as she realized with a start that Van Horn was very much aware of what he was saying and doing. He was no raving megalomaniac. Nothing that simple.

"Actually, Mr. Reed, if you must

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know, I'm beginning to have my doubts about——"

Van Horn moved quickly to interrupt. "Look, Reed, if we're prisoners, tie us up. If we're not, then you can return my helmet. We have our own messages to send."

Ellen wanted to scream. But Reed just stood there, the tic at his temple pumping away. Then he turned to Mark Osgood and reached out his hand without saying a word. Osgood stepped into the next room, retrieved the transparent globe, and passed it to Reed, who handed it to Van Horn.

"Thank you," Van Horn said. "We will return within the hour."

He pulled the helmet on, sealed the locking ring, and marched out the door. Ellen hurried to follow, leaving no gap between the two of them.

She waited until her own helmet was sealed and they had cycled through the air lock before letting out the scream.

Osgood escorted them across the floor of the shattered dome to the Marsboat, and watched as Van Horn climbed to the upper deck. But before Ellen could follow, Osgood touched her arm and tapped his helmet. She clicked through the channels until she found the one he was monitoring.

"I don't know what you're planning, but I just wanted to tell you that the assemblyman is not as unstable as you seem to think," Osgood said when their radios were linked. "He's been under a lot of stress in the past year. But the rest of us here are just as committed as he is. This isn't an issue that can go away. And don't make the mistake of dismissing his arguments because of your all-important Project."

"I wasn't going to," Ellen said. "I can write them off on the merits."

She saw Osgood frown inside his helmet, then shake his head. "Look, Engineer Brindamour, you may think Winston Reed is just a wild-eyed romantic, but he is the leader of an important movement. He speaks for a lot of people who are very concerned about the future of our planet—the original planet, not this one here. Maybe this isn't the best way of making a point—coming to Mars like this. But we believe in what we stand for and if this is the only way we can get the attention of people, then we'll do it. Everyone in this camp feels the same way. We are not mindless followers of a raving fanatic. That's just what you in the Engineering Corps want people to think. We are determined to be heard. It just so happens that Assemblyman Reed is in a position to speak the loudest. But that doesn't mean you can write the rest of us off."

Ellen felt a little cowed by the intensity of Osgood's pleadings. And for a moment, she felt disoriented as she reconciled his arguments with the simple preconceptions she had carried with her into Hellas. But only for a moment.

Then she noticed Van Horn fumbling with the air lock and all her fears resurfaced.

"All I'm concerned with right now, Mr. Osgood, is getting myself and as many of your committed friends as I can out of harm's way. You seem to be determined to get yourselves all killed, but I do not want to join you."

She switched off the radio and turned

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away before she could hear his response, leaping to the upper deck and hurrying forward to help Van Horn inside the boat.

"Human Science is not quite the same thing as physics or chemistry," Van Horn said. "It lacks the numerical accuracy of the older disciplines. But underneath it is a powerful geometric precision all its own. And a logic just as rigorous as anything you'll find in physics or chemistry."

They sat in the darkened control deck, their faces lit by the glow of the instrument panel. Van Horn looked tired, weary, and unlike any engineer Ellen had ever known.

"Circles and arrows. Open curves and closed curves. If you look at life as matter in motion, it all boils down to open curves and closed curves. Lines and bodies. Matter and energy. Circles and arrows. Life is erotic in every dimension. Feminine circles and masculine arrows. Periods of history are dominated by one process or another—or various mixtures of the two. Great expansions dominated by strong men leading the way into the wilderness. Powerful conflicts that turn inward and become self-destructive. Times of unifying change marked by the rise of great women and the ebbing of male dominance.

"Society is healthy when both processes are strong and oriented in the right direction. When one overwhelms the other or turns inward and becomes restrictive, society becomes irrational and the processes need to be diverted.

"That's where the Intervenor comes in."

Ellen was feeling calmer now that they were back in the boat. At least she had the means to return to the Bunker. But for some reason, she didn't think that was going to be their next move.

"The Intervenor? Do you really think they're going to send one in?" She sighed, then frowned. "Besides, if Human Science is so exact, why do we need Intervenors?"

"Because most ordinary people know nothing about the Science. And most people are quite ordinary. The problem comes when they are put in positions of extraordinary power—like Winston Reed."

"That's for sure."

"Like most ordinary people, Reed is somewhat self-centered, a little alienated and not terribly objective. Like most ordinary people, he lives in the world inside his own mind. He responds to the ideas he has about the world as if they were real. But the real world never gets near him. According to the Science, he inhabits the tiny circle of the self and has never left its limits."

"Sounds familiar—like my brother. So why is Reed different?"

"If that's all there was to it, we probably never would have heard of him. But he has an added problem—or rather his problems developed as he matured. His self-centered world-view demands perfection from an imperfect Universe. When he couldn't get it, he began to imagine a more perfect world, conjuring up some imaginary vision of a Golden Age of the past when the world was smaller and less crowded. Of course, the only way to achieve that world is through a massive and intrusive use of force, controlling people's lives and

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making them conform to Reed's vision of perfection."

"I'd like to see him try. I told you where I grew up. A neighborhood full of breeders. They never thought twice about what they were doing—three, even four kids to a family. And think about what it would do to the extra kids. The way people treat a second child is a crime. My grandparents treated me like I had a plague. The only one who ever sounded like he understood was my uncle—and he was a second child, too. I can't imagine a world where everyone would be treated that way."

"And neither can Reed, if the truth be told. His imagination doesn't extend to details like that. And according to the Science, *his tiny little circle is surrounded by arrows, all pointing towards him.* The normal direction of growth and development has been reversed. He is drawn to romantic, utopian visions, but they only serve to hide the destructive and regressive reality underneath. This attempt at martyrdom is the logical consequence of the process."

"It's too bad he dragged his followers along with him," Ellen said.

"They've got their own problems. Similar to Reed's, most of them. The others want to submerge themselves in a cause greater than themselves, surrender control over their lives to Reed and his plans. If it weren't for his followers, Reed would just be a troubled man. But there are so many people looking for something to belong to, he can't help but attract them. And that's what brings in the Intervenor."

Ellen drew in her breath suddenly. She looked at Van Horn, studying his face, his hands, his eyes. His uniform was new and unworn, his haircut fresh. A terrible apprehension came over her as the truth finally hit home.

"Judge, jury and executioner, all rolled into one," he said. "You've heard of social engineers; well, the Intervenor is a social repairman. When things reach a crisis, someone usually calls for one. When they analyze the crisis and decide it's bad enough, they usually send one.

"You were right, you know. A lot of what they do is never heard or seen. At first, they try to move into a situation without intruding, assuming a role, pretending to be part of the background —until the time comes to act. Usually they try to avoid taking any direct action. *Let things play themselves out,* that's normally the best track."

She bit her lip to keep the scream inside. He couldn't be—but he had to be.

"It's a difficult task to take on that role. To keep the truth a dark secret for as long as possible, no matter how much pain is involved. It's a lot like pretending you're not a woman when the fact is obvious for all to see." He looked Ellen straight in the eyes. "I'm sure you know what I mean—on both counts."

She felt her guts quiver, then harden. Damn him. Damn his intense eyes and the special vision that let him see into her heart. He was right. She was wrong and had been all along. Van Horn was no self-appointed savior. He was also no engineer. The end of the mystery left her secure within herself once again. Her fear that his blundering would get them trapped and killed among the Greenies evaporated as she realized the depth and breadth of his real plan.

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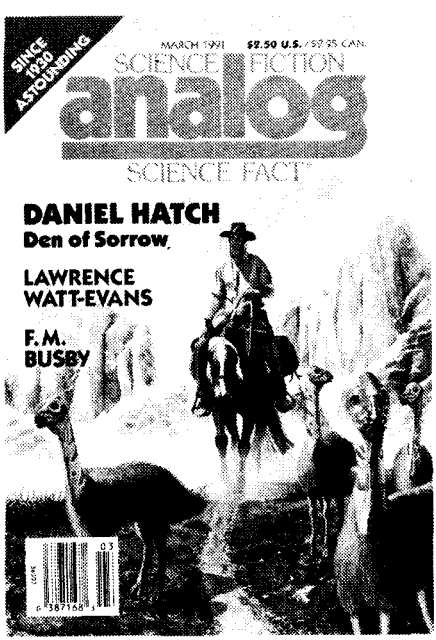

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But now a share of the burden of his secret had shifted to her. She knew what he meant about the difficult task he faced—now that she faced it too.

And that remark about pretending not to be a woman. What was she to think about that?

"What do we do now?" she asked.

"We wait," Van Horn said. "I want him to sweat for a change instead of you."

"And then what?"

He sighed, ran his hand over his face, and squeezed his eyes shut, then looked at her. "A healthy personality needs both circles and arrows, in balance and integrated. When someone is missing one or the other, you have to provide it for them—more or less. That's oversimplifying it, of course, because they always have both aspects. They just deny one side of themselves. So you have to oppose the side they've become stuck on—become their opposite. Force them to face the side they're hiding from."

"You mean face him down again like you just did?"

"I'm afraid so. . . . "

An hour later, they returned to the tent to find an agitated Reed seated in the small chamber of the tent. He looked worse than before—his face was a pasty grey and his eyes were rimmed with dark circles. His coarse hair was alternately plastered to his scalp with sweat or sticking out erratically. He twisted his hands nervously. To Ellen, it looked like he would have been pacing the floor—if you could do such a thing on Mars without literally bouncing off the walls.

"So now you've returned to finish your business, I presume," Reed said.

"In a manner of speaking," Van Horn replied. "We want to—"

"Well it won't do you any good," the politician said. "We are committed. You know what you're going to do is wrong. This is a whole planet with a special environment all its own. You can't just destroy it. It's not a marsh to be bulldozed. You know, back in the 20th century, when the greenhouse was just beginning to heat up, governments refused to notice. They refused to do anything to stop the burning of carbon fuels. They wouldn't build power satellites. People opposed nuclear plants. No one would act until the storms began to roll across Europe and the Midwest. History has held that generation to account. They will go down as the great villians of our race, fiddling like Nero while Rome burned. But you, you and the rest of the corps will have a record that is even worse. You are going out of your way to destroy an entire planetary ecostructure—an entire environment—in a single stroke. Deliberately. It's almost too big a crime to imagine. And you can't even begin to conceive of the guilt you will have to bear. My death and the deaths of my followers will be only a small part of that crime, symbolizing the murder—the death of a movement—a planet. The guilt . . . the tragedy . . . the crime . . ."

Reed's eyes glazed momentarily as he lost track of his words. Ellen felt a sudden pang of sympathy for the man as the stress mounted. For a moment, it seemed as if at last he had sensed the finality of this melodrama, the reality of death behind his bluff.

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Van Horn took advantage of Reed's exhaustion to make his move. Ellen Brindamour held her breath.

"You realize, don't you, that you're overlooking one inconvenient fact? There is no ecostructure here on Mars because there is no life. When we are through, that will all change. We will create the ecostructure—air to breathe, water to drink, soil to plant in."

"But the lie—the myth that mankind can continue to grow without limit or end. That cannot be allowed to endure. That is why the Intervenor will come. That is why he will stop the ice from falling. . . . "

"Winston, the time has come to face reality. The Intervenor is not going to stop the ice.

"Your problem is that you are a one-sided thinker. You cannot imagine any point of view but your own. You put ideas before reality. You put principles before practicality. For you, abstractions take the place of concrete facts. Emotion substitutes for thought and thought for emotion.

"This process has run its course. You are trying to reverse a policy decision that was made fifty years ago."

"But the Intervenor—" Reed protested weakly.

"What makes you so certain that the Intervenor hasn't already come and decided the issue?"

Reed's eyes darted frantically back and forth between Ellen and Van Horn. He seemed to be looking for some sign from them, some confirmation that he was still in control of the situation. But they could give him none.

"There would be an order, reversing the plan, diverting the asteroids. We would have been told. Mark, no message has come in, has it? No, I didn't think so."

"I don't mean a decision in your favor, Reed. I mean against you."

"But that's impossible. They wouldn't do that. They couldn't. There still would have been some action, some order served. Why hasn't the Intervenor come here to talk to me? Why haven't I been told? No, Van Horn, you're . . . "

A glimmering of light appeared in Reed's rheumy eyes, then a panicky tremor seized his hands. "No, not you," he said. "You can't be. They wouldn't do that to me. You're an engineer."

Ellen pursed her lips, then pressed forward. "Sir, I can attest to the fact that Mr. Van Horn is not what he appears to be."

Reed turned pale. For the longest time, he held his breath, keeping motionless as he calmed himself. The tremor eased and a renewed strength filled his eyes. "In that case, you will still not be able to remove us from here—not voluntarily. You are going to have to be the one to use force."

"This isn't about force, Reed," Van Horn said with sudden anger. "If it was about force, I'd leave you out here for the ice. This is about reason, and it's time you started exercising yours. Terraforming the planets is the path that humanity has decided to take. Reversing the growth in population is a choice they have decided against. You can only take an idea so far and you become irrelevant—and that happened to your cause before you were born.

"When that first chunk of ice hits the middle of the basin, you and your fel-

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lows will all become martyrs. But by the time the sixth one hits, you will all be history. It will be too late. We do not want you to die. We want you to return home and do some good. Figure out what that may be on your own, but come home and try. At least let your followers go if they want to. Believe me, it serves no useful purpose to remain here and die."

"I—I don't know what to say. My friends, my supporters, I've brought them so far and on so little hope. Now, to turn back . . . Mark, help me. Tell me what to do . . . "

Ellen wanted to turn away from the spectacle of the man's total collapse, but she could not shirk her responsibility. She had had a part in this, no matter how small. She watched as his mouth quivered and his hand twitched. His eyes went blank and his shoulders went slack as he slumped in the chair in Mars's minimal gravity. Mark Osgood came to his side and took Reed's hand in his, then shot a look of unreserved fury at Van Horn before turning to his leader.

"How much time do we have left?" the aide asked after a moment, keeping his back to them.

"Enough," Ellen said when Van Horn did not answer. "Probably even enough to pack up your camp before you leave. It seems like a lot of expensive equipment to let go to waste."

"We'll be ready," Osgood said. "Call your people."

Darkness came long before the Greenies had packed up their camp. The lights from their orbital lander threw sharp cones of blue across the interior of the shattered dome. Ellen watched as they deflated the tents, packed up their supplies and loaded the lander, filing in and out like large, dumb ants.

No one moved quickly and no one seemed to sense the urgency of the task that she did. But at least they were moving.

Mark Osgood found her sometime before midnight. She was not so quick to shun him now.

"I see what you and your partner were up to now," he said. Ellen blushed at being mistaken for an Intervenor, but did not correct Osgood's error. "You don't really think you've stopped us though, do you?"

"I'm not sure," she said, hoping to draw him out.

"Well you won't. Just because Winston Reed is stopped doesn't mean the Green Party is through. Or that we're going to stop fighting for Negative Growth. There are limits to the number of people a world can carry. We've met those limits on Earth and if we don't change, some day we will meet those limits on Mars. And then we will have destroyed two worlds instead of one. Winston may have been wrong to come here. Maybe he shouldn't have tried to confuse the two issues—Mars and Earth. There are other ways to make our point, though, and as soon as we get home I'm going to start working on them."

"And how are you going to do that? More stunts like this? Would you like to go swimming on Venus next time?"

"You can be sarcastic if you want, but you can't just toss away the Green Party. There are a lot of intelligent, motivated, and concerned people behind us. What we are working for is still

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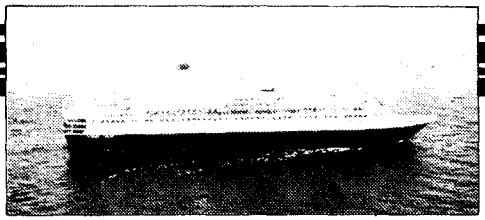

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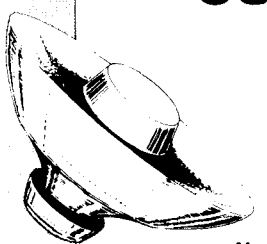

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just as valid. And after this incident, maybe there will be more people willing to support us. What good does it do the world to waste resources building arcologies where people turn their backs on the outside and live only for the world inside themselves? What good does it do to repeat the same old mistakes on an entirely new planet?''

''Not much, I suppose,'' she said. ''But what makes you think we're going to do that? People change. They respond to problems as they present themselves. But you just can't force them to move at your pace. You have to give them time.''

''That's what you Intervenors always say. But no one is going to change unless they are forced to. And if you and your partners try to stop us every time we make an effort, then the world will always be in the mess it's in.''

''Intervenors don't stop change,'' she said quickly. ''They step in when they have to, that's all.''

''Of course,'' Osgood said. ''You aren't defenders of the status quo at all. Just good scientists, working to protect us all from ourselves. I should have known better than to try and change your mind. I guess that's impossible if you've already made your decisions in advance.''

He shook his head, then turned away. Ellen said nothing as he walked off, but climbed back aboard the boat and went inside.

''They don't look too happy,'' she said a short time later when Van Horn slipped into the seat beside her and offered her a cup of coffee.

''They're not. The Green party is not one of your mainstream political groups. It tends to be a one-issue organization. Whichever issue gets the most attention will dominate their activities. Anyone who isn't interested in it will find something else to do. And a lot of their members find themselves attracted to the mainstream parties where they can accomplish something real. The combination of push and pull really works to put them out on the fringes.''

''And now that Reed has given up?''

''They'll wander around aimlessly for a few years until some other cause gets them going.''

''That sounds harmless enough, I guess. Goodness only knows what they'll pick on next. Or does your Science tell you that, too?''

''Not at all. It's analytical, but not predictive. We have to play it by ear, just like everyone else.''

''Then you can make mistakes?''

''Naturally. We're just as prone to human frailty as the rest of the race. Just because we have knowledge available to us doesn't mean we use it properly—or at all.''

''Maybe you're wrong about the Greens then,'' she said.

''Oh? And what makes you say that?''

''I talked to Mark Osgood tonight.'' She recounted her conversation with Reed's aide. ''I think he's serious about making a difference. I think he could turn around and surprise you. He's not going to wander around aimlessly. And he's not going to let one issue dominate his activities—even though he's been wrapped up in this one. I think that by getting rid of Winston Reed, you've cleared the way for Mark Osgood to take

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his place. And he's not a self-centered or irrelevant old man. He's sharp and tough and likely to get things that Reed never could. Did you ever think of that?''

''Briefly,'' Van Horn said. ''You know, your arguments sound quite strange for someone who's spent their life in the corps. When did you become a supporter of the Greens?''

''I'm not supporting them. I just think there's more to them than you seem to.''

Van Horn smiled, then chuckled to himself. ''You're starting to sound like an Intervenor.''

Ellen felt her face grow hot and a chill ran down her back. She fought the momentary embarrassment, then asked: ''How do you get to be an Intervenor, anyway? Who decides to let you make these kind of choices for the rest of us?''

''Some of us study for it. Others are recruited. The entrance requirements aren't overwhelming. You just have to think clearly and objectively. And it helps to be willing to question authority. I'm afraid that lets out 90 percent of the human race, though.''

''Oh come on, it isn't that bad.''

''Maybe I'm exaggerating a little bit. But after ten years at this, I'm not so sure anymore. This is the kind of job that gets to you after a while. I'm afraid I may be losing my effectiveness these days.''

''You seemed to do all right with Reed.''

''Not really. The problem comes when you lose your sympathy for the people you have to overrule. And when that happens, it's time to retire.''

Ellen looked at Van Horn's tired eyes and sagging features. ''Did you lose your sympathy for Reed?''

''Almost, but not quite. I hated to do that to him, but in a crisis like this you don't have any choice. I just wish I'd gotten to him sooner—before he left Earth.''

''And if you had?''

''None of this would have happened,'' he said with a sigh. Then he frowned. ''And as far as you are concerned, none of this did.''

''I thought every Intervention was a matter of public record.''

''There was no Intervention. The Intervenor was not necessary. There was only a crazy old senior engineer who talked Reed out of killing himself and his supporters. That's the way the record will read and that's all anyone will know.''

''You really think so?''

''Yes, I do. That secret truth will not come out. As for the other secret, that's up to you.''

''What other secret?''

''That inside Assistant Engineer Ellen Brindamour there lurks a sensitive and strong young woman—not a selfless robot designed to serve the corps.''

Ellen suddenly felt embarrassed again, but at least not ashamed. He was right, of course, but what was she to do about it? The corps needed selfless robots more than it needed sensitive women. She said nothing, but sipped her coffee and watched the Greenies load their lander.

They finished sometime in the middle of the night. But by then, it was too late to do any flying. She told the lander pilot to wait until daylight before they made the trip back to the Bunker. The

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next day, they lifted themselves into the dusty Martian sky and headed for home.

Thousands of monitors and instruments recorded the impact of the ice when its orbit finally intersected with that of Mars. Ellen and the rest of the engineers watched on the vidscreen in the main conference room. Images from orbit revealed the awesome drama.

The asteroids were visible only briefly on the screen, falling the last six hundred kilometers in less than ten seconds. They landed in sequence, one after the another, the interval between impacts the length of a single breath. They hit with bright bursts of intense blue light that turned black at the heart as the image burned too brightly for the image processors.

When the fire faded, a dull red glow was left in place, surrounded by the spreading ripple of the shock wave as it cleared the dusty air before it. Ellen could almost feel the six tiny holes in the crust, arranged in a geometrically perfect hexagon. Then she realized that they were tiny only in perspective. The reality of it was something else entirely. She knew that Hellas had turned into a cauldron of fire and wind.

The ice turned to plasma on impact, splashing high above the Martian surface. Then it cooled to superheated steam, rushing forth from the bubbling craters in the floor of the basin.

The seismic waves hit the Bunker first, rocking the floor and rumbling through, one shock after another until all six had passed. Reverberations continued for an hour. And at the end of the hour, the clouds of steam had reached them. By now, it was condensing into moisture.

The vidscreen still showed the view from orbit, where the great bowl of Hellas Planitia was now clear of the yellow dust that had filled it the day before. But across the room, the curtains had been drawn back to reveal the wide bay windows that looked out towards Savin Rock and the mountainous rim of the basin.

Ellen drew in her breath in awe as the mile-high wall of white water vapor rushed towards them, sweeping the skies of the thick haze that had hung there when she left in search of Winston Reed. The windows were suddenly assaulted by a splattering of rain—rain on Mars!

The scene disappeared before the onslaught, thick grey clouds closing in on the Bunker. Ellen waited a long time for the sky to clear, and when it did, the yellow dust that had filled the thin air had been replaced by a faint haze that tinted the distant mountains blue.

Later that day, the rain swept across the planet, cooling as it spread, turning at last to snow that fell on the slopes of Olympus Mons, in the great canyon of Vallis Marineris and across the layered ice of the poles.

She almost missed Van Horn's departure from the Bunker two days later—but not quite.

It was only luck that put her in the hangar when he fell into the line for the orbital shuttle. She saw him from across the great chamber and was about to bound over to make her farewell when Engineer Forester appeared from the machine shop.

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She bit back a curse. Two days of life without running into him had made her soft and spoiled.

"Well, Brindamour, I see you had quite an adventure out in Hellas," he said with a sneer. "I guess you gave those Greenies a good kick in the butt. I know I would have done the same if I'd had half a chance."

Ellen swallowed her anger and started to turn away, then reconsidered.

"Forester, why don't you go bother someone who cares about what you would have done," she said, packing all the contempt she could muster into her voice. She remembered what Van Horn had said about providing a sick personality with whatever it lacked by standing in opposition to it. What Forester needed was someone to resist his arrogant bullying—and to put him in his place. "You know, I think the only reason you push women around is because you're afraid of what might happen if you were nice to one."

Forester's jaw dropped and his face turned white. Ellen left him that way and bounded across the hangar towards the shuttle.

"Mr. Van Horn," she called. "Wait a minute, please."

Van Horn stopped, and the other passengers filed past him. "Engineer Brindamour, I was afraid I would have to leave without saying goodbye."

"Tell me something, Mr. Van Horn," she said as a sudden wave of giddy excitement overtook her. "How does a woman join your group?"

Van Horn smiled and took her hand in his. "If it's you, all she has to do is ask. . . ." ■

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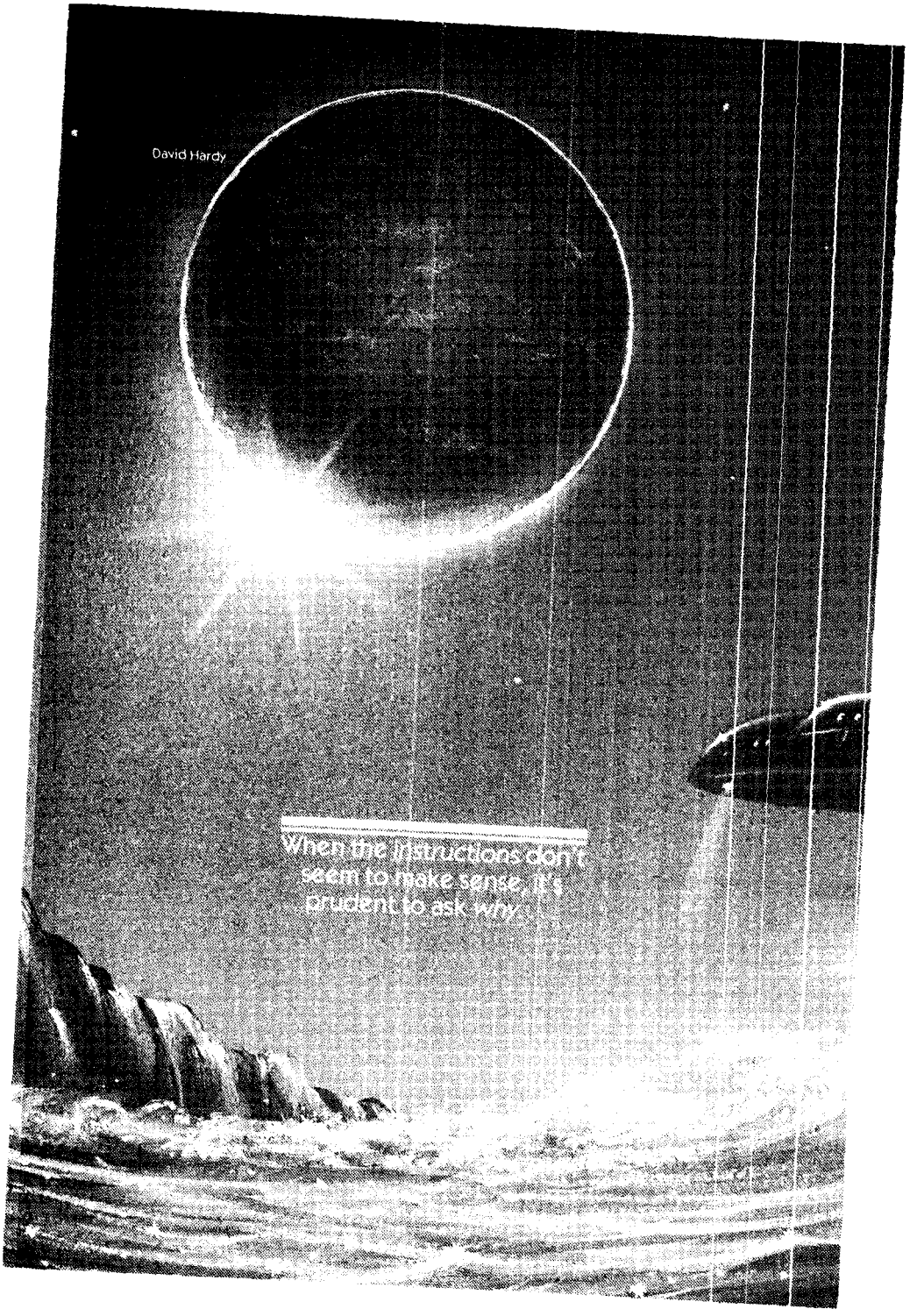

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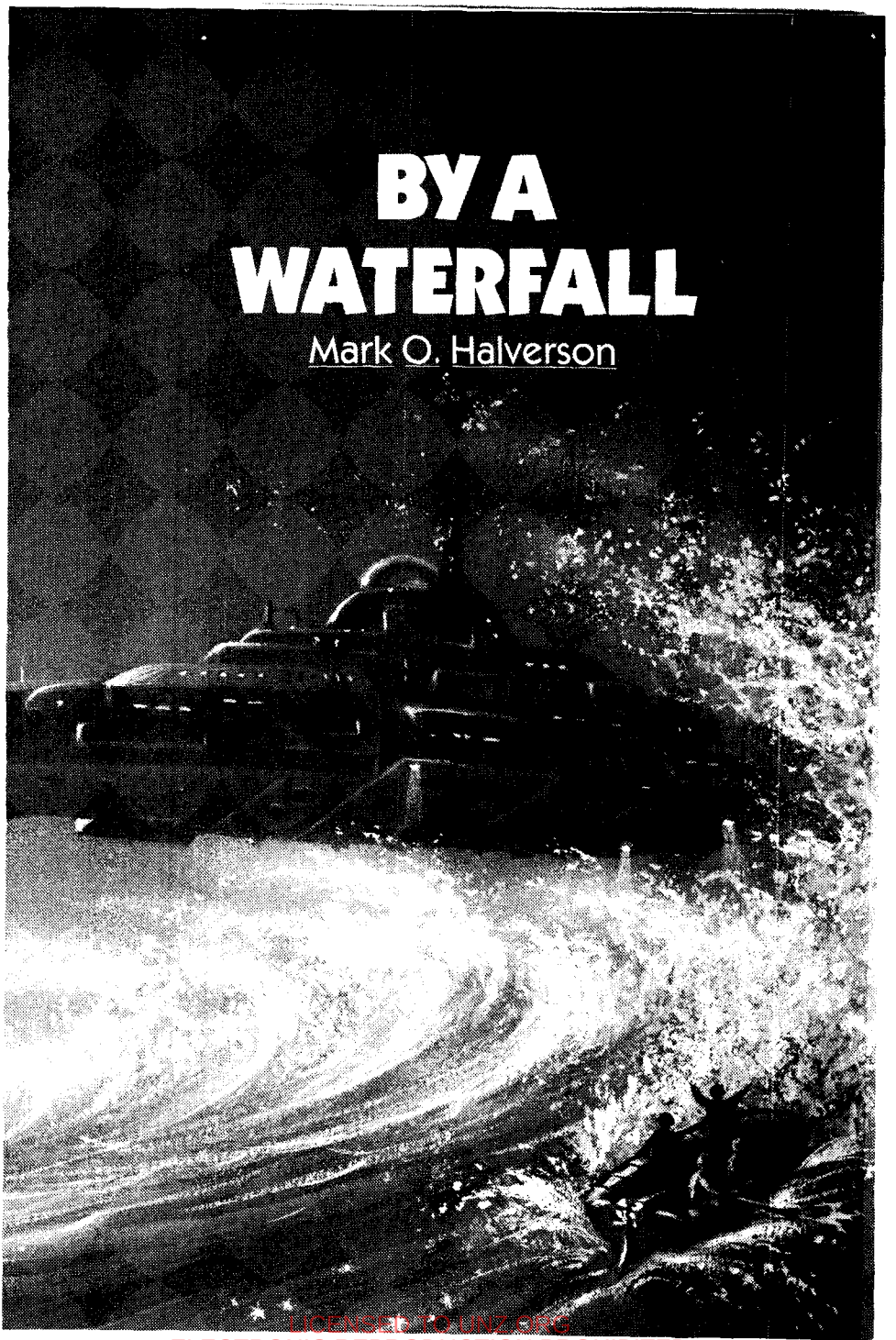

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Our new planet was no Wonderworld, but making it here to Symmetria was certainly a lot better than being burnt to gray ash in the deep-space fire. Besides, the living was easy.

I spread a mat on the ground and sat down. Moments later I sensed movement: another tremor. My mate, Sibyl, appeared shortly carrying two pair of utility glasses (*ugls* we called them), presumably loaded. She didn't mention the ground tremor: they were too routine.

"What are we going to watch?" I asked.

"It's a Busby Berkeley thing, early Twentieth. The musical numbers, I understand, are really great."

"Sounds good to me."

Sitting down beside me, she said, "I was lucky to find both *rocs*." In Plymouth's *ugl* library there were at least two of each *roc* (I think the name came from read-only-cube), but sometimes one or both would be checked-out.

She handed me my *ugls*. Instead of putting them on, I lay back on the mat and looked at Oceanus. She did the same.

"It's nice to see something besides stars in the night sky, isn't it?" she remarked.

"It sure is."

"Those dark nights before Oceanus came up, having to stay inside so much gave me space-fever. I feel a lot better about Symmetria now."

I could not have agreed more.

Evening was certainly the best time to enjoy Oceanus. At two-hours-plus after sunset, these nights it became almost-full, then started into eclipse. The eclipse would last another two hours and something, halfway through which—at the moment of its perfect fullness—Oceanus would totally blink-out.

The planet had first poked above the eastern horizon seventeen Symmetrian days before, and an Earth-size planet five times as close as the Moon was to Earth gave us fantastic nighttime light; so little wonder that it had lifted our spirits. Before that—those first eight dark nights on Symmetria had sorely tested everyone. Twenty-one hours of darkness, with only the stars to light your way. Go outside without a beam and you'd stumble about, maybe fall into a lake. Well at least no one had drowned: in *our valley* (the plain between the great cliffs to the east and the gentle up-slope and drop-off far to the west), lakes were rarely deep enough for that. Canal Lake was the exception.

Since planet-rise, Oceanus had climbed until it was centered almost 30 degrees above the eastern cliffs. Familiarity breeds contempt, as the ancient saying went, and now it seemed that many colonists accepted the planet's benevolent nighttime light as their mandated right, but otherwise gave Oceanus little conscious thought. Well, eighty-eight days ahead (by my reckoning), there would be a solid Earth half-year of dark, dark nights. Sibyl and I were of a mind to enjoy Oceanus while we could.

We studied the cloud systems, which were the only features of Oceanus that ever changed. Storms on Oceanus—assuming that's what the cloud systems were—did not form into well-developed cyclonic swirls, like on Earth. Some of

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us speculated that Oceanus rotated very slowly (like Symmetria), causing the swirl-making coriolis accelerations to be puny.

As we watched, Oceanus started into eclipse: the round, black shadow of Symmetria began to devour it. Presently, the blackness would swallow Oceanus totally before moving on.

"Do you think there's any land poking through up there?" Sibyl asked.

Our first view of Oceanus had been from Symmetria-orbit, and we probably hadn't seen much of the planet's far side yet. But everything we had seen of it, to date, was ocean. "I don't know," I answered, "but it stands to reason that Oceanus is rotating. Eventually we'll find out."

"If we're still here."

"Right—if we're still here." I was pretty sure we would be.

I reflected on the accident that brought us to Symmetria. Traveling with everyone in biosuspension, except a part of the colony ship's crew, a piece of errant space-material had hit. From what the ship's captain told us later, the struggle to survive and find a place of refuge for us had been desperate. There was a fire, and the holoarchives—both the ship's and those destined for Plymouth—had been burnt to a crisp (I could still remember that distinctive electrical-fire odor). But at least the planet-module Plymouth, itself, was intact—holoarchives or not.

Anyway, we "awoke" in this strange system, far short of Wonderworld. And through the viewports we saw our new main-stage sun and planet pair: Solis (the names came later), a sun slightly larger and hotter than Sol; Symmetria (which we orbited), the planet of supersymmetry with the great circle-oceans; and Oceanus, a single shining circle of blue water, areas of it covered in clouds.

From orbit, Symmetria appeared all lines and circles. The most impressive features? The oceans: twin great bright circles of blue at opposite sides of the planet, each bisected by the equator, each extending a third-the-way around the globe. The ocean circles just touched polar circles, so that circle touched circle all the way around Symmetria. Each polar circle was a bull's-eye of polar ice and an outer ring of mountains and valleys—the *mountain latitudes*, we quickly dubbed them.

Everything outside the circles was flat plains cut by meridional lines. The lines? More than sixty of them, particularly prominent in the equatorial latitudes, they looked like lines dividing sections of a peeled orange—if an orange had that many sections. They ran from pole to pole, or possibly they did. (The oceans and the polar ice hid evidence of them there, and elsewhere the lines trailed off and became indiscernible, just into the mountain latitudes.)

The astronomical data were mostly lost in the fire, but the ship's crew did produce a chart of the Solis system. Amazingly, the footnotes described Symmetria as colony-grade 5. Imagine, *CG5!* the highest rating. Just as good as Wonderworld! That meant it had breathable air, abundant water, fertile soil, a good climate, and lots more. The footnotes included sketches of the lower mountain latitudes, showing locations of the supposed best landfall stations on the planet.

But . . . *wouldn't it be damned cold*

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at those stations?—many of us wondered. *How can they be CG5?*

With the urgency from the deep-space accident, there was precious little time to deliberate. The ship's captain ordered us to make landfall on Symmetria at one of the footnoted stations, said the colony ship might not hold out long. We argued some, particularly Sibyl—she got into quite a scrap with the captain. But he put us off anyway. So we left the colony ship in the planet-module Plymouth, Rowland Graves in command.

Though the charts said we should head for one of the mountain-latitude sites; I and quite a few others wanted to send out ground probes first. Well, Rowland Graves went along with that—it *was* good procedure, after all. So we rushed two probes to Symmetria, and . . . conditions looked impossibly good. *At the equator!* The mountain-latitude site? It was just as cold there as we'd feared.

So again we wondered, how could the mountain-latitude stations possibly be CG5? Well, the Colony Syndicate had made mistakes before, so about twenty of us—I was the ringleader — talked long and hard to Rowland Graves. Graves still wanted to set down at one of the footnoted sites—ground probe or not. That's what the chart said, and that's what Graves meant to do. (He had more trust than I in the Colony Syndicate, infinitely more trust than Sibyl had.) But I—we— talked him out of it. No, we didn't change his thinking. It's just that he didn't want a mutiny on his hands. So while the colony ship limped off toward the Wonderworld corridor to seek help—down we came in Plymouth, almost smack-dab at the equator.

Graves set Plymouth down near the equatorial ground probe, about three times closer to the west ocean than the east one. And so here we were at Station Equator (our new neighborhood on the meridional strip of land we dubbed *our valley*), Canal Lake and a third-of-a-planet-plus line of vertical cliffs just sixteen kilometers to the east of us.

There were many lakes around Station Equator, but except for Canal Lake they were all small and shallow. Still, they provided drinkable, if somewhat salty-tasting water. People speculated on the saltiness, and "lots of minerals in the ground" was the consensus explanation. No one really knew, though, and it turned out not to matter. It rained from time to time and new ponds formed by the runoff held the good-tasting stuff. And you could break open the indigenous tubulars—they held sweet water.

We came out of the space accident much better, overall, than we could have hoped. Plymouth was undamaged and its fusion generators hummed; the planet module was a place to live and take refuge and could be for centuries. Meanwhile, we would be transmitting "Maydays!"

The food stores had made it to Station Equator just fine, and Symmetria had a carbon-based food chain that might give nourishment. If not, the soil was good, and the genetically-engineered "release-pallets" were in perfect condition. Of course, *they* had been matched to Wonderworld. But with a little luck . . . Well, we had that luck, plenty of it, and the tropical release-pallets—the *TR7* stuff—spread unbelievably fast.

Symmetria was no Wonderworld, but life at Station Equator suited most col-

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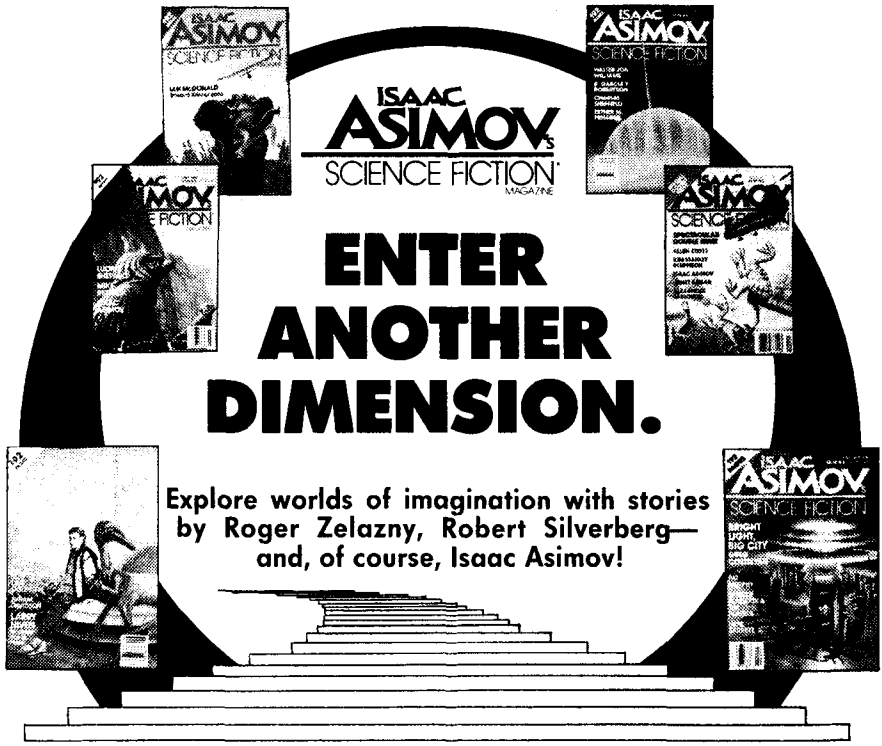
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onists just fine. The weather was downright balmy. The days were usually hot (fortunately, Plymouth's air-conditioning worked fine) but the nights were comfortable. And the living was easy. Except for the release-technicians, colonists spent much of their awake-time eating, socializing, watching the *ugls* and . . .

Well—*to hell with birth control!* we all decided. Maybe this wasn't Wonderworld, but we might be here a long, long time. Plymouth had an excellent infirmary and three of the colonists were medical doctors. So before long many couples were *expecting*.

We soon invented new systems for direction and time. North became the direction of the slightly-nearer pole (we even found a new "Polaris" star to sight north on). That made Solis rise in the east and set in the west, and those of us from Earth felt comfortable with that. As to units of time: a day became a Symmetrian day, and noon and midnight became Symmetrian noon and Symmetrian midnight. The terms week and month now seemed useless, so we dropped them. But we kept hour and year, and they still meant Earth-hour and Earth-year. A Symmetrian year? We would need a new term, but hadn't invented one yet.

Before making landfall, there hadn't been time to gather much data on our planet pair; but since that time, we had found out quite a bit.

Symmetria and Oceanus, both Earth-size, revolved around their common center of gravity each 41.7 Earth-hours; and because the plane of revolution was also the plane of the ecliptic and because of one other fact—that basically defined the Symmetrian day. The other fact? Over eons, strong tidal effects from Oceanus's gravity pull (it seemed the logical explanation) had stopped Symmetria's rotation. *Almost*. It was similar to the Earth-Moon pair, where now the same side of the Moon always faced Earth. Except that Symmetria still rotated. But very slowly.

The equatorial-plane from that rotation aligned (as did the plane of revolution) with the plane of the ecliptic; so like Solis, Oceanus would rise in the east. But it would do so only about once each Earth-year.

There would be no seasons on Symmetria: the equatorial-plane didn't wobble and the distance to our sun held rather constant. So the balmy weather, it seemed, would prevail. And with the *TR7* release having spread rampantly and the indigenous water-bearing tubulars to draw on, there would be plenty to eat and drink. So we could live the good life on Symmetria through millennia to come—or until "rescue" came. Paradise or a bore? It depended on what motivated you.

Symmetria had its mysteries, though. *Like the lines and the circles and the symmetries!* The meridional lines (like the 150-meter-high cliffs alongside Canal Lake) presumably marked great rifts in the crust. But what caused the rifts? And what caused the oceans to be circles and why did the oceans sit on the equator? Then there were the mountain latitudes and the fact that they formed circles around the poles. . . . We talked about all of this a lot, but we really didn't have answers. The holoarchives had been destroyed in the fire, and there were no

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geophysicists or planetary geologists in our group. Only colonists.

Since making landfall the myriad lakes—except Canal—had been gradually drying up. It was puzzling. The water levels just dropped and dropped until, for the smaller lakes, nothing remained but muddy bottoms. Then the mud dried and you could walk about on the hard surface. It still rained rather regularly, so there didn't seem to be a dry spell coming on. But maybe, we speculated, it had rained even more before we made landfall. The consensus was, it was a temporary thing.

As the plain became dryer and dryer, the indigenous tubulars started to harden and go to seed. But the ship's stores were loaded with food and water, and the *TR7* release had spread—who knew how far? So no one was too concerned, and—

"Are you going to look at Oceanus all night?" Sibyl suddenly interrupted my musing. Oceanus was half eclipsed by then.

"No. I was just remembering—well, nothing important. So what's on for tonight?"

"A Busby Berkeley, I told you. Put on your *ugls*."

I did, and she put on hers. "Ready?" she asked.

"Ready . . . *now*," I replied, and pushed the start button on the right stem. Might as well laugh and cry *together* during the movie.

The glasses blacked over for an instant and then the movie started. I twitched the left-stem micro-dial to sharpen the focus and straighten out the 3D: the previous user must have needed correction on that eye. The movie was contained in the three dimensions of the *roc* optical cube. I remembered the holocartoons on how it worked: two micro-lasers of different frequencies would scan through the cube's internal grid and read the movie off—bit by bit—as the beam-intersection point migrated, and the bits would be converted to right- and left-perspective views on the lenses.

The movie was corny but thoroughly enjoyable. We watched it and held hands, oblivious to the world around us. As I understood it, the original Busby Berkeley movies were in 2D, not to mention black-and-white. Well the *roc* versions, as with everything else, were computer enhanced: they were in color and true-perspective 3D, and in modern-quality sound. Like the light of Oceanus, you took technology like that for granted until you were deprived of it.

There was one particularly lavish musical number that evolved into an intricately synchronized water-ballet with plenty of beautiful girls. It was built around an enchanting song, the lyrics of which went, "By a waterfall . . ." and I heard Sibyl humming along with it. Then too soon, it seemed, the movie was over. I switched the *ugls* off, and Oceanus reappeared.

"Want to watch anything else?" I asked. A *roc* usually held eight or ten hours of movies, or whatever.

"Not right now," Sibyl replied, slipping her *ugls* off. For a long time we just lay there, looking at Oceanus. Finally we went inside Plymouth to join the perennial rec-room bull session.

An afternoon siesta period and the ten hours before dawn were the official

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sleep periods. Well, I didn't make it through the ten hours. Sibyl hadn't yet stirred so I got dressed and walked outside.

I looked to the east; no sign of Solis yet. I found the mat we'd left outside from the Busby Berkeley movie—thank god Rowland Graves hadn't come across it first—and lay down. Oceanus was a huge thinning quarter-planet; it would keep thinning and then largely disappear in the light of day until it eclipsed our sun. The eclipse would be *total* and last for over two hours.

The eastern horizon became light and Solis finally showed itself. Before long, some of my two hundred fellow colonists made it outside to enjoy the morning and search out the tubulars and the *TR7* goodies that now were everywhere. I saw Bart Freeman—alone, his girlfriend hadn't showed up yet—with the ancient design blue frisbee he'd somehow smuggled onto Plymouth. He tossed it in my direction.

Sibyl appeared and sat beside me on the mat. She was pregnant, but it hadn't slowed her down yet. I broke off half the tubular-stalk I was munching on and offered it to her. It was tasty roughage, but could you live on it? Official doctrine was—you shouldn't try to find out.

Rowland Graves walked out the open main-bay door and down the ramp, looked about, and frowned. "I don't think we should be eating those things," he broadcast. "This experimenting could get us in a lot of trouble." He came closer, looked disapprovingly at my half consumed stalk. "There's plenty of food in ship's stores, and the *TR7* release—well, the genetics are Earth. So why not eat *that?*" Graves liked everyone to go by the book. And he was—*technically*—our leader.

"Sorry, Rowland," I tried to mollify. I threw down the tubular and Sibyl did the same. No use getting him upset. He'd soon be back inside Plymouth, worrying over scheduling or whatever, and be out of our hair. Sure enough . . . Graves looked around for awhile, then was back up the ramp.

"What an ass!" I heard to my right. It was Bart Freeman. He would tear into Rowland Graves whenever the chance came, though never in Rowland's presence.

"Oh, I don't know," I said noncommittally. Rowland exasperated Sibyl and me just like he did plenty of others, at times, but we tried to keep it in perspective. I wasn't going to play Bart's little Rowland-baiting game. Not after all the friction and bad feelings Bart had stirred up during the arguments over where Plymouth was to head.

"Is the guy senile or what?" Bart tried again. "Maybe that's how your brain gets when you can't cut it anymore."

Now that remark was making me angry, but before I could think of anything to say I heard, "Well you ought to know, Bart," coming from Sibyl. Bart shot us a dour look, then stalked away to try his game on someone else.

Bart's last cut against Rowland Graves referred to the fact that Graves was keeping pretty much to himself and hadn't taken up with any of the women. Well, little wonder about that. His wife hadn't made it out of biosuspension, and the guy was still pretty broken up about it. Of course, Bart Freeman probably couldn't appreciate that.

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We put thoughts of Bart Freeman from our minds as quickly as possible, and went back to enjoying the morning.

"Jonas," I heard, "would you mind very much if we *never* made it to Wonderworld?"

What a question. We had been lucky to get a colony-ship berth at all. The well known colony worlds were — money-wise—out of reach, even with the government subsidies. Then the Colony Syndicate broached this wondrous "undiscovered" new colony world, the price manageable. Maybe it was all those promos we sat through on Earth, but to me the planet had everything you'd ever want. It was diverse, like Earth, with the tropics, the temperate zones and so forth, but everything was more spectacular. Early on, we'd spontaneously stopped referring to the planet by its dull official alphanumeric and started calling it *Wonderworld*.

Everything that grew or moved around on Wonderworld was Earth-origin, but it was only the good stuff. Prickly plants, annoying insects, poisonous snakes? No way! Overcrowding and pollution? With only a few thousand people—hardly! Want to live the easy life in a tropical paradise? No problem. Want to work and struggle and forge a new society? Easily arranged. Whatever you wanted, it was on Wonderworld. Or could be some day.

The catch was . . . we had to act superfast on the Colony Syndicate's offer. So we did, and here we were. But on Symmetria, not Wonderworld.

"I think, maybe, I would," I finally addressed her question. "Station Equator sure isn't hard to take, what with the good climate, and now Oceanus to look at nights. But maybe life here is *too* easy. There's no challenge. Now, you take Wonderworld. You could go where you had to struggle and take chances but could accomplish something in life. Personally, I'd take that route.

"How about you?"

"I'm in no hurry, but . . . me too, I guess. I need some struggle and hard times to keep me motivated. Besides, I like mountains—*big* mountains—and Wonderworld has plenty of them."

"You're sure right about that. On Symmetria, everything's either flat or repetitious—"

"You mean the lineaments?"

"Right, the lineaments. From what I remember seeing from orbit, one line of cliffs is likely to look pretty much like the next. And there are doubtless more than sixty other Canal Lakes on this planet, just like ours."

"How about the mountain latitudes?"

"You've got a point there: the mountain latitudes aren't repetitious. But—" I gave my best false shiver "—it'd sure be damned cold up there."

"Well it's not cold here. And as far as I'm concerned, Canal Lake, with the high cliffs right there next to it, is plain beautiful."

I couldn't argue with that; I loved Canal Lake and the cliffs too. But it would be nice if there were other marvels on the planet to see some day.

"And we mustn't forget the oceans," she added. "They could be interesting."

Now *that* observation had real merit, and I said, "You've got that right. Plymouth should be at the oceanside right now; then we could spend time at the beaches every day." Graves had set

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Plymouth down where the ground-probe said everything was OK. I couldn't fault his logic; still, a Station Oceanside would have been *real* nice. Maybe if rescue didn't come and if we ever learned how to cross the cliffs, I'd take Sibyl and our kids-to-be to the ocean. Why not go? The *TR7* stuff seemed to have spread everywhere, so even if the tubulars didn't work out, there would be plenty of foodstuff about just to live off the land. We had nothing but time, and it would be quite an adven—

"So . . . you'd give all this up and take me to Wonderworld?" Sibyl's words broke in. From her tone, she wanted to talk some more about that grand planet.

"Yes, I'd go to Wonderworld with you; but I don't know how many of the others would go. With the easy living and all, some people seem to like things here just fine."

No response.

"Of course, some people's thinking might be plain messed up," I added.

"Like whose?"

"Like Rowland Graves, for example."

"Rowland Graves doesn't care about the easy living," Sibyl returned. "He likes it here because he goes by the book."

"What do you mean?" I asked.

"Remember the colonist training program, and leadership class?"

"Yeah."

"Well, Rowland Graves *taught* leadership class for years and years."

We hadn't taken leadership from Graves, but I remembered the class well, nonetheless. No matter what the situation, you were supposed to think upbeat, see the good side. It inspired your people, kept them in a positive frame of mind. Well, Rowland Graves may have hailed from academia, but he had written—*literally* written—the Syndicate's book on leadership. "I see what you mean," I finally said.

I felt a bit ashamed that I was picking on Rowland Graves. "Let's talk about something more interesting."

"I'll give you something interesting."

"What's that?" I asked.

"Either something is very strange or my equilibrium's suddenly shot."

"How so?"

"Well, when we first set down on Station Equator it seemed liked the plain around these parts dipped downward to the west just a tad. Lately, the ground seems to have gotten awfully damned level."

That started me remembering.

"You probably think I'm imagining it," she said.

I didn't think she was. The last trip out to the lake I'd had the same thought, but had dismissed it as *my* overactive imagination. I tried to figure it out, and she mistook my silence for doubt.

"Maybe I can prove it," she suddenly said, pulling me by the hand. "Come with me."

She led me inside Plymouth to the bridge and a bank of level-readouts. She looked at them for a moment, then said, "*Aha!* Off-level, just like I thought." I looked at the readouts too. They ranged from .029 to .032 degrees, all showing that Plymouth tilted downward to the east. "The hydraulics," she explained, "were adjusted to where the readouts showed point-triple-aught and

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then locked in, four days after touchdown. They haven't been messed with since." She should know: the hydraulics were her responsibility.

I played devil's advocate. "The ground could have settled," I said. "The tremors, say. The tilt amounts to—" I mentally calculated "—only two or three centimeters, or so, differential vertical movement over the length of Plymouth. It doesn't necessarily prove anything."

"Well, I think it does," she argued. "Why should Plymouth settle that much after already having stabilized for four days? And even if it did, why would it settle differentially? The ground's totally homogenous right here; and Plymouth's mass is uniformly distributed, as is everything inside of it—Graves saw to that."

"I don't know," I admitted. She was probably right.

We went back outside and sat on our mat again.

Rowland Graves appeared next to us shortly after that. "Did you check the inflatable back in yet?" he asked.

He referred to the eight-person craft that we kept at Canal Lake. (The term *inflatable* was somewhat inaccurate—the stern was necessarily made of rigid compfiber to support a joulepak and clamp-on propulsion module, and everything else inflated out forward from the stern.) The Colony Syndicate had stashed three identical such craft aboard Plymouth, and Graves had finally—after considerable badgering from me—released one of them for lake use. But keeping even one of them at Canal Lake made Rowland nervous: Colony equipment was to be kept overnight inside Plymouth.

"No we didn't," I finally answered, not trying to hide the sarcasm. "It's a sixteen-kilometer haul from the lake and that thing's pretty heavy. Then there are the solar collectors we set out and the joulepak. It'd be a major effort to lug it all in." I could have added, the stuff's all designed to be left out in the elements, so what's the problem? But instead I said, "We did leave everything on high ground, well back from the water; and it's tied down so the wind won't mess with it."

Rowland Graves still looked unhappy.

"We're probably going back out there today," Sibyl improvised. "Maybe tomorrow, too, so the inflatable won't just sit there unused."

That seemed to defuse him, but he still looked unhappy. "We can't let that equipment get scattered. When you finish up at the lake—tonight, tomorrow, whenever—please bring everything back with you."

Neither one of us said anything, so he walked back inside.

"*That guy!*" I flared. "Doesn't he have anything better to do? The trouble with this place is, things are too easy. There's nothing to keep him occupied, so he finds something."

"Don't let him get to you," Sibyl said, "he's just trying to do his job. And Big Yellow—there are days when no one at all is at the lake to use it. Maybe Rowland has a point."

Well maybe he did, but it wasn't practical to haul all that stuff back and forth. "I'll talk with him about it," I finally said.

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Our good friends David and Sarah made it outside about then. The bandages were off David's right arm and the wound looked mostly healed. David and I had tried to climb the cliffs that rose from the east side of Canal Lake— free-hand!—since we had no climbing equipment. It was an impulsive thing and could have ended far worse. We were sitting in Big Yellow (as we called the inflatable), joking about having a look from the top, then suddenly we were on the rock face. I took the lead. We followed a vertical joint in the rock and were presently sixty meters above the water. Then we ran out of rock-joint (or maybe courage). Wedged there in the crack, we decided that nothing on top was really that worth seeing. We agreed that the meridional strip of land to the east would be just like *our valley*. We'd look down the gentle western upslope for maybe three-hundred kilometers (not that we'd be able to see that far); and beyond that, a wide plain would eventually end at another Canal Lake and another line of vertical cliffs. So we decided to climb back down.

The adrenalin had mostly played out by then and the descent was downright scary. We made it about halfway down when David slipped. He pushed out as he did, so he alit in the water; but he banged his arm along the rock face on the way down. The girls fished him out, and when I got a little lower I jumped out into the water and joined them in Big Yellow. David's arm was really a mess. He was in no condition to walk the sixteen kilometers to Plymouth, so it took an extra trip, a stretcher, and some volunteers to get him to the infirmary. I had expected Graves to blast us for making the climb, but he didn't.

"Looking good!" Sibyl called, referring to David's arm.

"It certainly is," Sarah returned. "I told David he'd have to quit babying himself."

"Sure," David said in mock seriousness, "I use my arm as an excuse to goof off. Like . . . would you mind gathering some *TR7* goodies for me to munch on? Don't want to take a chance with this busted arm."

"Look Dave boy," Sarah said, "when we get to Wonderworld, life's not going to be easy like it is here. You won't be able to dope off on account of some miniscule scratch on your arm; so you'd best learn to make do, right here and now." Sarah was teasing, but she'd earned the right to lord it over Jim or most of the rest of us, if she wanted. She was a release-technician, and had worked damned hard with the pallets and the release-machinery while we non-release-technician types had easy duty.

David flashed his disarming smile. "Hey! I was counting on taking life easy from here on. Now you tell me I'll have to get off my butt, bad arm and all."

It was hard not to like David. Sarah more than liked him, and they were expecting, too.

"Please join us," Sibyl cheerily invited.

"Yeah, pull up—if I had one—a chair," I added. "You can take the which-way-is-downhill? quiz."

"What on Ear—Symmetria—is that?" Sarah asked as they sat down next to us.

"My lovely Sibyl, here, believes that

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things are not as they were," I explained. "She thinks that the ground, hereabouts, started out dipping west, and that now it has become flat, flat, flat. . . . And you know what?"

"What?" Sarah laughed.

"I think she might be right. Anyway, she showed me Plymouth's level-readouts, and they seem to back her up. Anyone else notice anything?"

"Sibyl, you're probably right," Sarah responded. "Walking around out here, I've also had the sensation that something's different. I just haven't been able to figure out—"

"Do you suppose that *that!*—" Sibyl pointed above Solis to where Oceanus would be "—has anything to do with what we're talking about?"

I pondered it. Oceanus was *very* close and *very* big. "It just might," I said. "Maybe it causes the tremors, too. There's a lot of mass out there, and I'd be surprised if it didn't stress the rock formations plenty as it moves across our sky."

"Well, there's *one* thing I feel good about," Sibyl said.

"What's that?" Sarah asked.

"Jonas, here, was thinking that Graves should have put Plymouth down by the oceanside so we could spend time at the beaches. Well, I'm getting the creeps from all this which-way-is-downhill? stuff, and right now I'm glad he didn't. If Oceanus is causing all this weirdness on dry ground, what would it do to all that water?" She gave a nervous laugh, but she was serious.

I patted her back and said: "Well, you don't have to worry—do you? —'cause we're not by the ocean." I was smiling, but images of blue circle-oceans and Oceanus stuck in my mind.

"You know," Sarah said, "this whole business on Symmetria—not just the which-way-is-downhill? stuff—has been pretty weird as far as I'm concerned."

"You mean the *TR7* release?" Sibyl asked. I remembered Sarah bringing that up before, but I hadn't paid much attention.

"That's right, the *TR7* release. I never have figured out that *V10* thing."

Sibyl seemed to know what she meant. I tried to remember; it rang a bell, but . . . "What about the *V10?*" I asked.

Sarah smiled, then nailed me. "You weren't paying attention the last time, were you?"

"I can't remember everything," I evaded. "Refresh my memory on this *V10.*"

"Well to start out . . . ," she gave me a mock imposed-upon-at-having-to-repeat-herself look, "the *TR7* part just means it's a tropic release for certain climatic ranges. The complete release alphanumeric is *TR7V10—V10!* if you can imagine it, and no other letters and numbers to the right of that."

I must have given her a blank look. "The *V,*" she explained, "stands for *velocity.* That indicates how fast the release can move across the surface of a planet. Say we're talking about a particular variety of fruit: the number trailing the *V* would take into account the cycle time—seed through fruit to seed—and the rate of movement across the planet by wind, bird, insect or whatev—"

"And a ten is somehow strange?"

"It sure is. The trailing number is a

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relative order of magnitude thing. Now in release-technician class, I never heard of anything higher than a seven. A ten is—well, incredible. And since there's nothing else trailing the *V10*, propagation velocity was the only damned thing the genetic engineers even worried about.

"Just think of the implications. Each release-pallet holds lifeforms from each of the five kingdoms; it's a start for a stand-alone human supporting ecosystem. Well, a ten means that every lifeform on the pallet has to be a ten. But to get tens, the designers would have had to restrict themselves to the zillionth of a percent—or whatever—of Earth life-forms with the highest propagation velocities and then genetically engineer the red hell out of those. Someone threw away an awful lot of diversity and went to an awful lot of genetic-engineering trouble to put together pallets like that."

I was trying to puzzle it out and my face must have shown it. "Doesn't that strike you as weird?" Sarah pressed. "I mean, why in the world would they be so obsessed with propagation velocity?"

"I see what you mean," I finally agreed. That *was* weird.

"The semi-tropical releases," she went on, "are also *V10*. But you know what? I've checked out the temperate and sub-arctic pallets, and with those, the designers weren't paranoid about *velocity* as opposed to everything else. So why the difference?"

We talked about it a while, but no one came up with good answers.

It was getting on toward noon. David's arm was looking quite healthy and we were feeling bored, so we started out for Canal Lake. None of the other colonists, to my knowledge, would be there, so we would have Big Yellow all to ourselves. After Sarah's lecture on *V10* and propagation velocity I paid more attention than usual to the *TR7* stuff. I noticed new edibles and types of birds and flying insects that I hadn't seen before. Sarah was right, I decided. I'd never heard of a release taking hold that fast before.

At the lake a surprise awaited us. *We saw spouts of water!* This was totally new.

There were two of them, just west of the lake. One was little more than a spring, but the second was a jet of water two meters high. We checked it out; the discharge rate was constant and the water was cold. I sampled it; it tasted brackish like the lake water. We watched the spout for a long time, wondering when it would stop. If anything, the force of it intensified.

"We'd better report this to Graves when we get back," I heard myself say. "He should know about this." Ordinarily, if someone else had said that, it might have annoyed me: Graves had his finger in too many pies as it was. Was the day's strangeness getting to me?

We unhooked the bulky joulepak from the solar collectors and hoisted it into its starboard-side receptacle in the compfiber stern of Big Yellow. Then we clamped the propulsion module to its place on the stern, next to the joulepak, and plugged it into the joulepak. The four of us then lifted up Big Yellow, hauled it from the high ground down onto the water, and stepped into it. (The *high ground* I'd mentioned to Graves was only a half meter above lake level,

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so it wasn't much of a haul.) We pushed out a couple of meters and I lowered the module's prop into clear water. I sat down onto the compfiber steersman-bench at the portside of the stern, threw a switch, and we heard the familiar hum. Though the propulsion module had little oomph, it could move the inflatable along OK—backward or forward, it didn't matter too much; and the joulepak could run the module for hours, many times the few minutes it would take to reach the cliffs. The craft nominally carried eight people: the steersman, six along the sides—where Sibyl and Sarah sat facing each other, and one near the oval-shaped bow, where David relaxed. We had plenty of room to stretch out.

Why go to the cliffs? Well, certainly not to repeat our climbing misadventure of some days back. It was just that, for one thing, the cliffs were plain beautiful. Lying there in Big Yellow at the base of them, looking 150 meters straight up across the yellow-red-gray bands of rock, you could imagine you were back on Earth. Or maybe on Wonderworld. The experience was uplifting. And the swimming was great. You couldn't see bottom—the water was far too deep for that; but you could swim alongside the sandstone and cool yourself off, hold onto the rock to rest yourself when you got tired.

But today, a surprise awaited: *more spouts!* Within our view, four of them issued from the lower part of the great rock face. One spout sent water a good three meters out over the lake, and the waterfall effect was quite spectacular. Fascinated as can be, we watched it for a long time as it intensified. It was all downright eerie.

What strange sort of underground hydrology had caused all of this? We talked about it during the inflatable ride back, but no one had any concrete ideas. The thing we came closest to agreeing on, though, was that Oceanus was somehow the culprit. So big, so close—think of the tidal forces that Oceanus would be generating. First, tremors . . . now a disruption of the underground water system: it seemed plausible, so why not blame Oceanus?

When we reached shore and secured Big Yellow, we discovered a new spout there: the water bubbled up a half-meter high. The impressive spout from some hours before was now even more impressive, and you could hear it from a distance. We watched it another half hour or so, then headed west back toward Plymouth, munching *TR7* goodies as we walked. By the time we arrived the sun had already started to set. Graves was unhappy.

"Where have you been?" he wanted to know as we approached Plymouth. The ground was blanketed with footprints where he had been pacing. "I was about to get a party together," he said gruffly, "see what happened—"

"Graves, there's some really weird stuff going on," I said. Without waiting for him to ask what, I told him about the spouts. Darkness fell and we wanted to go inside and rest up awhile, but Graves was determined to know every last detail, and he kept after us interminably.

The spouts became the talk of Station Equator that evening. Sibyl, David, Sarah and I sat together, talking, under

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the light of Oceanus, and everyone else crowded around us. Presently, that included Graves, who stuffed himself down next to Sibyl and me.

"So what do you think is happening?" he asked, looking around at the four of us.

No one else answered right away, so I said: "We're thinking that the spouts, also some other weird things, have to do with *that*." I pointed at Oceanus, which was coming up on full planet.

"How so?"

"Well . . . take the lineaments, for example. You've seen them from orbit. Why do you suppose they give the peeled-orange look we talk about."

"You seem to have a theory," he returned, "so why not just explain it?"

"Fair enough. Well, I'm thinking that the lineaments are maybe caused by Oceanus. Tidal forces from the planet must stress the crust here, plenty, as Oceanus moves across our sky. My knowledge of planetary geology isn't that great; but maybe those tidal forces —over the ages—are breaking up Symmetria's crust and pulling up one plate relative to the next around the planet, making all those lines of cliffs. That could explain the tremors. And Canal Lake, too, for that matter."

"The lake?"

"Sure. Maybe the fault zone has become a topographic low, or something like that, and Canal Lake just follows it. That would explain why the lake goes on and on to the north and south, just like the cliffs. I don't know, it's just a theory."

Graves thought about it awhile. "So what does that have to do with the spouts?" he asked. "If Oceanus being close by caused them, why weren't they there before?"

"Oceanus is getting higher in the sky—it's maybe thirty degrees above the horizon now. The tidal forces are different, maybe stronger than they were. I think they might be warping the underground hydrology—"

"Hydrology?"

"Yeah, the underground water pressures, water flow and the like. Anyway, it's just my thinking. I could be wrong."

"Hmm . . ." was Graves's response. Then a while later: "We'll have to check this out." He went back inside Plymouth, presumably to do some planning.

Morning was still some eighteen hours away; so we watched the eclipse become total, then recede, and talked some more. From what people were saying, it seemed likely that every last person would bolt to the lake in the morning. (For some reason, that made me uneasy.) The *ugls* and the *rocs* gave you all the vicarious pleasures you could want, but Symmetria did not routinely offer new real world experiences. So people were anxious to see the new wonder—the spouts—for themselves.

When the talking had died down, Sibyl and I started to watch a late twenty-first century deep space adventure on the *ugls*. Trouble was all I could think about was the lake and the spouts. Eventually, that got me remembering the water-ballet stuff from the night before. Great minds must think alike, because part way through the deep space adventure I heard Sibyl humming, "By a waterfall . . . " So we quit the deep space thing and watched the Busby Berkeley water ballet again.

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Except for the fog-diminished light of Oceanus diffusing through the viewport, it was dark inside our compartment when the bell sounded. I staggered out of bed and made it to the door, and there stood Rowland Graves, looking grim. "I'm getting worried about those spouts," he said, as I motioned him inside and turned on the light. Sibyl sat up in bed and rubbed her eyes. "I know they're sixteen kilometers away from us," Graves continued, "but the ground's pretty damned flat. What if we get flooded?"

"Not near enough water-flow for that," I reassured him. "It would take years for the spouts to raise the level of Canal Lake appreciably." But my tone of voice didn't inspire confidence; possibly because I was wondering, What if the spouts got bigger? . . . Maybe a lot bigger?

Graves seemed to read my lack of conviction and not my words, and his expression turned even grimmer. "Thanks, Jonas, I'll get back with you later. Sorry for waking you people up." He abruptly turned and left.

I didn't sleep much after that, and I ended up at *his* door, four hours before dawn, to return the wake-up favor. But Graves was already up. In fact, he was on the verge of coming down to our compartment again.

"We've got to monitor this flooding thing," he started out.

Well that's what I had come to talk to *him* about. "The four of us can go back to the lake and check out the spouts," I proposed. "We'll take a couple of radios this time. Whether the spouts change or not, we'll keep you posted."

"That's a good plan," Graves said, "but take, say, a couple more people with you." He handed me a sheet of paper with two names written on it. "Let's get all the different thinking we can on what's happening. After you get there, we can decide over the radios on what to do next."

Then I brought up something that was bothering me. "I don't know how you're going to stop them, but I suggest you don't let everyone tramp off to the lake today. If there's some emergency—and I'm not saying that that's likely—you'll need plenty of people right here."

He surprised me with, "That's already been taken care of."

I had no idea how he'd taken care of that situation. I just hoped that he really had. Anyway, I had my own preparations to make, so I left to get our party together.

Dawn was still well over three hours away when we were ready to head out. But I did one further thing: I went to the library, found the galactic-encyclopedia *roc*, that included tides, and loaded it into my *ugls*. Maybe I could learn something more on the walk over.

The predawn fog was everywhere, yet crescent Oceanus illuminated the route quite well and we made good time. Part way out, I put the *ugls* on. Everything was black for an instant, then I pushed the micro-button for heads-up display. In front of me was an index. I scrolled through it—using the standard code of right eye, left eye blinks—until "tides" appeared. Of course, there was nothing in the cube about Symmetria or

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Oceanus. Just general stuff, some theoretic equations and plots pertaining to Earth and two other planets. It seemed there was nothing useful about the effect of tidal forces on underground hydrology, so after a while I gave up. The *ugls* went back in the case.

We had kept up a steady pace, mostly abreast except for Bart Freeman and his girlfriend, who lagged behind. Yes, Bart Freeman! who'd been bitching since we left about getting rousted out of bed so early. I'd been surprised to see his name on Graves's list until I remembered the guy knew a little geology. Or had Graves just wanted him out of his hair? It didn't matter, I guessed. At least the girl was a good type. She was really very bright—except for her falling for Bart. Bart wasn't about to commit to one girl as long as there were still unattached or willing females at Station Equator.

About the same time I cased my *ugls*, Bart and the girl started to play with the frisbee that Bart had brought along. I'd hear laughing every once in a while, and sometimes the frisbee would sail across my peripheral vision. (Graves would have been down on such frivolity, but as long as they kept up, I didn't much care.) At one point, the frisbee skipped off the top my head from behind, glided to the ground in front of me, then went scooting along another couple meters.

I heard embarrassed laughs from behind, but then the laughs faded from my awareness as a very discordant thought came to me. I stopped, looked down and pondered the frisbee: it was a circle of deep blue in the light of Oceanus, reminiscent of a Symmetrian ocean as viewed from orbit. I nudged the frisbee across the ground with my foot; and as I did that, the song from the Busby Berkeley movie inexplicably popped into my consciousness and wouldn't let go. The discordant thought turned to near panic.

"What are you doing?" Sibyl laughed.

"Oh, nothing," I said, and I resumed walking. But my blood ran death cold. *Is it possible?!* the question rang through my mind. *How could I have overlooked something like that!*

Sibyl sensed something was wrong. "What is it, honey?"

"Nothing I can be sure of. I need to think." Back on went the *ugls* and the heads-up display.

Let's see . . . I tried to puzzle it out as we walked. I started scrolling through the frames again, saw spheroidal equations, charts, pages of descriptive text, but nothing that appeared useful. Well, I'd have to quantify this thing somehow. With any luck it would be a false alarm, something to laugh about later.

I tried—by extrapolation—to intuit from the frames the nature of the Symmetrian tides. . . . Well, for one thing, the complete tidal period would be about one Earth-year: the period of our planet's rotation, relative to Oceanus. And as with the lunar tides on Earth, tides on Symmetria would be largely governed by horizontal force. Wherever at on our planet, such tide-causing force would be the horizontal component of . . . Oceanus's gravity pull *minus* that same gravity pull at our planet's centroid (since that was balanced out by orbital-motion force). If the oceans were free to migrate—the thought that had panicked me—then this tide-causing force (the same force that had caused Plym-

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outh to show a downward tilt to the east) would work to pull water higher and higher toward that migrating mathematical point on the equator closest to Oceanus, from which Oceanus would hold forever at high-noon position in the sky. On the opposite side of our planet, the same thing. In short, the force would shape the oceans into sort of wrapped around, flattened spheroids—circles as viewed from space —that would wash around the planet as Oceanus moved across the sky.

Still . . . all that was theory. Maybe the great, blue oceans I remembered from space *couldn't* migrate, and were simply locked in basins that were circular, for whatever geological reasons. The tides, after all, would have to be pretty damned high to wash around the whole planet. Well, to solve that puzzle I'd have to somehow figure out how high the tides could get. Ten meters? A hundred meters? Higher? (I hoped the hell not.)

In the meantime, we couldn't chance doing nothing. I had to talk with Graves.

"Go on ahead," I told everyone. "I have to attend to you know what; I'll catch you in a bit." Sibyl wasn't fooled, but she left with the others anyway. I disliked feigning the nature call. I would have talked freely in front of everyone else, but I didn't want to get Bart Freeman all stirred up and argumentative right then. I needed a cool head.

When they were out of voice range, I got on the radio to Graves. David carried our other radio; if he thought to turn it on and Bart heard—well it didn't matter, they'd all know soon enough. "Rowland, we've got a problem," I announced when I heard his voice. "A bad one." I told him my thinking on the spouts. He wanted to know if I was sure. "Hell no I'm not sure!" I blurted. "We still need to put some figures on the tides to see if they're really a problem, then check out what's actually happening at the lake; and I'll keep you informed on that. But to be on the safe side, I—"

"I understand," Rowland said. "I'll go along with whatever you want." I told him what I thought should be done and he said he'd get everyone on it. Right then, I felt pretty damned good about Rowland Graves.

"Of course, it'll probably turn out I'm wrong," I said, "but we can't take a—"

"I understand," he repeated. "You can count on us at this end, just keep me filled in."

I stowed the radio back in its case, and caught up with the others.

To put some numbers on the tidal problem, I had the idea of scaling up from the height of lunar tides on Earth. I knew that the mass of Oceanus was about eighty times that of the Moon, but I needed some reasonable value for the lunar tide. Some more scanning with the *ugls* and a bit of adjusting for the size of our circle-oceans (for purposes of scaling up I assumed they were indeed migrating), and I came up with a half-meter rise. I put the *ugls* back in the case and tried to conjure up a scaling formula. The gravity pull from a moon or an Oceanus would be proportional to mass divided by distance squared, of course—the universal law of gravitation. The tide-causing force, as I saw it, was rather akin to a spatial differential of this gravity pull (the horizontal-

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component stuff wouldn't matter in the scaling). That meant mass divided by distance *cubed*. And that was the formula I needed.

I was ready to start scaling up. *Let's see . . .* I mentally calculated . . . *multiply the half-meter lunar tide by eighty to compensate for Oceanus's larger mass . . .* (That sure didn't look good.) . . . *then—*

"What are you thinking so hard about?" Sibyl broke in. "Is it the spouts still?"

"Just bear with me awhile, honey. I've got to concentrate." I focused my thoughts. *Now . . . Oceanus's larger mass gives me forty meters . . . I multiply that by . . . the ratio of the radii cubed, which . . .* (I remembered that Oceanus was about five times closer to Symmetria than the Moon was to Earth) . . . *which is . . . one hundred twenty-five . . . So the forty meters times the one hundred twenty-five gives me . . . "MY GOD!"* I blurted out loud. Five-kilometer-high tides! Except in the mountain latitudes, there was probably nothing on Symmetria with a thirtieth that much relief.

I got on the radio again. This time I didn't worry about who might hear me. "Rowland, come in," I said loudly. No response. I tried twice more, then gave up. Rowland was busy with other things.

"We've got to make one quick check on the spouts, then get back to Plymouth as fast as we can," I announced. They all wanted to know what was wrong. "There's no time to explain it all," I answered. "But unless I'm wrong, there's going to be the biggest damned flood you could ever imagine."

We neared the lake a few minutes after that as the first light of dawn showed to the east. We saw two new spouts, and the water discharge from the other spouts had increased greatly.

At water's edge we took time to catch our breaths. It was lighter now and the fog wasn't too bad, so we could see the cliffs reasonably well. I broke out the binoculars. The old spouts were really gushing out water, and there were new spouts, one from much higher up on the rock face than before. A lot of water was spraying out of those cliffs. It looked bad.

But it got far worse. Solis showed about then and I had to shift the binoculars south and squint into them, but I saw rivulets of water suddenly start tumbling down the cliffs. The rivulets increased in number and width as I watched.

Desperate, I got on the radio again. This time I *got* Graves. "We're coming along pretty well," he said when asked. "What's going on at the lake?"

"It's plain bad!" I told him, and I hurriedly described what was happening. He said they'd pull out all the stops. "We won't try to foot it back to Plymouth," I said. "We'll meet you further west." I explained what I had in mind, and he agreed.

Everyone heard my talk with Graves, including Bart Freeman, who was first nervous, then suddenly hostile. "To hell with waiting here!" he argued. "I'm headed back to Plymouth. Come on!" he barked to his girlfriend.

"No! There isn't time!" I ordered, trying to sound very authoritative. "Big Yellow's our best chance!"

"Hell! You must be nuts! I'm not staying here with all that water coming at us!" He grabbed his girlfriend's

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hand. "Let's get going!" She tried to argue him out of it, but he wouldn't budge. He forced her to choose, and reluctantly she joined him.

"At least take these!" I yelled, and I tossed flotation vests at them. She caught one and held onto it, but he shot me an arrogant look and let the second vest fall to the ground. Together, they took off running west. I shouted after them a couple of times, tried to change their minds; but they didn't respond. Well . . . I wished them well.

Everyone else—why they had any confidence in me, I don't know—stayed put. "Help me with Big Yellow!" I yelled. We got the inflatable fixed up with the joulepak and the propulsion module, and hauled it onto the rising lake waters. By then the cliff top was an endless line of waterfalls. You didn't need binoculars.

Not long after I lowered the prop and switched the propulsion module on, the water level reached the high ground near the solar collectors. Water started out onto the plain, causing a perceptible west-moving current near the inflatable.

I put the prop into reverse and backed Big Yellow toward the cliffs and the waterfalls.

"Why are we going this way?" Sibyl wanted to know, just as I throttled back.

"To keep us back off a wall of water," I answered. I wasn't so sure, at the time, that there would actually be a wall of water. But no one argued with me after that.

I throttled back still further to where we just stayed in the lake area proper as the westbound current of water picked up speed. David sat forward of Sarah, starboard-side, and Sibyl sat across from them. Good: riding near the bow might become dangerous, and I wanted good visibility to the front.

Before long the cliffs became one solid waterfall that disappeared into the fog north and south of us. We could hear it, too, and its sound gradually increased to a chilling roar. I wondered about the water depth up there. Combining the five-kilometer-tide figure that I'd gotten from the scaling up with knowledge of how fast the circle-oceans were being pulled around our planet, I made a guess: the water depth at the top the cliffs would likely rise by three or four meters per hour. It was going to be very bad.

I let Big Yellow drift west with the current, which by now moved at a brisk walking speed. In a moment, we were out onto the plain.

. . . In Big Yellow riding the tidal flood west, bouncing along on the churning froth, running the prop in reverse, working the steering grip with my right hand, holding onto the craft with my left. Behind us, the thunder of a mighty waterfall. Ahead—the fog had started to burn off, and in the distance I could just make out the shape of Plymouth, immobile on the plain.

. . . On the radio to Graves. No answer. Well, Graves would do everything he could to get Plymouth away. He didn't need me wasting his time.

. . . Greater turbulence. Running the prop intermittently, now, to conserve power. Moving faster and faster as the rushing front of water transforms itself into a churning *wall*.

. . . Higher and higher the wall of water, and faster and faster it devours the ground ahead. We ride Old Yellow

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just behind the wall; we cannot see it directly, but it has to be a churning hell. If we are sucked into that—well I hate to think about it. We all wear flotation vests, but how could you live through *that?*

. . . I glance at my watch . . . an hour on the raft, now . . . seems more like a year. How high the water over the cliffs? Three meters? Higher?

. . . Moving west on Big Yellow faster than a man could keep up running, the wall of water shoulder-high. Behind us—progressively higher, swifter water rushes forward to build a progressively higher, deadlier wall. Ahead . . . through the last of the fog . . . Plymouth still on the ground!

. . . Also ahead, two desperate people. Distance runners would have made it to Plymouth by now; but these two were not distance runners. They were exhausted. Bart Freeman must have figured it was every person for himself, because he'd abandoned the girl to eat his dust, far behind him now. She still carried the flotation vest in her hand, though. Maybe . . . I worked the propulsion module to steer Big Yellow in her direction. Its power hadn't started to fade yet; it responded strongly.

Well before the wall of water arrived, the girl stopped, turned full around and strapped on the vest. She walked toward the wall, moving to our right to help us line up Big Yellow with her. Then the churning hell struck! It was eye level to her and moving fast; it instantly sucked her into its turbulence. For a seeming eternity . . . nothing. Then an arm and a half-torn-off vest jumped out of the water ahead. I steered for her, but the vest slipped free and she was under again. . . . A foot appeared, Sibyl got a hand on it and hung on. I saw some hair and wrapped my left hand in that, released the steering grip and grabbed an arm. Seconds later the girl was in Big Yellow beside Sibyl, coughing out water.

Ahead, a bare two kilometers from Plymouth, Bart Freeman fell to his side, completely done in. Right before the wall hit, he staggered to his feet and tried to line himself up with Big Yellow, like the girl had done. But the wall was deeper, swifter now. He disappeared into the churning hell and never resurfaced.

. . . *Plymouth still on the ground!* Soon the wall would smash against it, then swamp it. *Come on Graves!*

And Graves came through. At the last possible moment, Plymouth started to rise from its anchorage. We rode the wall's backside to the right of it while it was still only half its length above the ground.

Well, Plymouth was all right now. If my rough calculations were OK, we had a chance to make it, too. If . . .

. . . On top of that great tidal flood, rushing west across the plain. Higher and higher the wall, faster and faster our ride until the wet air blew firm against our faces. The water more turbulent now, Big Yellow bouncing viciously about. Drenched to the skin, we broke out the paddles to conserve joulepak energy. Paddling as Big Yellow thrashed about was perilous, but we managed it for a time. Paddling when we could, using the propulsion module when we had to, we kept ourselves above that deadly wall, hung onto life by a thread.

Our situation can't possibly get more

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desperate, I thought. But I was wrong. As we back-paddled to stay off the wall, Solis started into total eclipse. Soon the sky was black despair and we hardly knew where the deadly wall was. We stashed the paddles and relied on the propulsion module. We had no choice: if the joulepak went dead, so be it. . . . Two hours of blackness that seemed like an eternity. Then the eclipse receded and the sky was bright again. Our spirits lifted a bit, but not for long. The wall was running faster and higher and rougher. It just never stopped building! It was all we could do to keep ourselves in Big Yellow. We held on deathly tight as the air drove a constant spray of water hard against us.

. . . Six hours into the odyssey. Running the throttle full out in reverse still. Clutching onto Big Yellow with my left hand, the steering grip with my right, both arms aching. I guessed the wall to be eight meters high, moving twice as fast as a man could sprint. And it got even worse—*much worse!*—until I plain quit guessing.

I don't know how in the world we made it through all of that. But finally the wall began to dissipate against the start of the western-slope. And not long after that it was all over. The edge of the advancing circle-ocean had filled in our valley so that Station Equator was now part of the ocean depths, then settled to a turtlelike advance along the western up-slope after its surface regained its natural sphere shape. When it reached the western drop-off and the next canal lake, another great waterfall and another churning hell wall of water would ensue. I hoped not to be there.

After the turbulence subsided, we drained the last energy from the joulepak and paddled desperately until our arms and backs hurt from the effort. Finally . . . Big Yellow touched bottom. Momentarily. We clambered out of the inflatable and—helping each other along—splashed through the rising water to dry ground. Tired as we were, the feeling of relief was unbelievable. The water level still crept up the gentle western up-slope as the circle-ocean moved relentlessly onward, but the creep was steady and slow. A brisk walk and we gained ground on it.

It was past Symmetria–noon by then and we had ridden Big Yellow almost 280 kilometers (we later found out) from what had once been Canal Lake. Since we really hadn't known how far the tidal flood would carry, Graves had set Plymouth down near the western drop-off. I got on the radio to Graves and he made one last hop back to pick us up. We didn't get Big Yellow, but we got ourselves away.

Much later in *our valley*, the answer to the question "which way-is-downhill?" would become, for a time, "definitely west," as the sphere-shaped trailing edge of the circle ocean passed across Station Equator and presently worked its way along what we had once thought of as the western *up*-slope, leaving behind only Canal and a myriad of small, isolated lakes.

Graves took Plymouth up high and we made it here to what we call Station North. During the days since then, we (not just the release-technicians, but *all of us!*) have worked from dawn to dusk, almost nonstop, with the temperate and

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sub-arctic releases. Evenings are damned cold, and we spend our non-sleeping hours awake glued to the *ugls* or chatting with one another in the rec room.

It was during a rec room bull session, just this evening, that we got to comparing Symmetria with Wonderworld and lamenting that we hadn't made it to Wonderworld. David and I were going on and on, and Sarah was also. But Sibyl didn't say anything for a long, long time. When she did, it just about floored us.

"You're not going to like this," Sibyl said, "but you know what?"

"What?" we asked.

"I don't think there is a Wonderworld!"

At first I thought she was joking. She hadn't mentioned *that* idea before, not even to me. So I said, "How could there *not* be a Wonderworld?"

"Think about it," she said. "Why didn't we make it to Wonderworld in the first place?"

"The errant space material and the electrical fire," Sarah answered.

"Hmm . . . ," Sibyl said. "So we *conveniently* made it to *this* system. What are the odds against that in a damaged colony ship? And—again, conveniently—the archives are destroyed. So we wouldn't know the real truth about Symmetria, I'll bet. So we wouldn't find out that Symmetria is definitely not colony-grade 5. Probably not even colony-grade 2."

"But the electrical fire?" I argued.

"All the evidence we had for that was the smell of smoke—which could have been easily faked," Sibyl shot back.

"But why would they do that?" David asked, still smiling. He wasn't taking Sibyl very seriously.

"Well, there were a couple of hundred of us colonists and only about fifteen ship's crew and officers on the colony ship. If there hadn't been an emergency or—even if there had been—if we'd known what Symmetria was really like do you think we'd have let the ship's captain put us off the colony ship so easily? What better way to make sure a messy situation, maybe a mutiny, didn't start up."

That silenced David, and it got me thinking, too. Oh, there was definitely a planet *said* to be Wonderworld, all right—we'd seen it on the astronomical photos. But what if *that* Wonderworld was some miserable, uninhabitable hellhole? We really had only the PR stuff the Colony Syndicate put out to go by. What with modern animation, those grand scenes of Wonderworld we'd watched could have been just as fake as all their statistics then would have been. Still—just because it was possible didn't mean that that's what really hap—

"That rings true," Sarah was saying. "It ties in with the release-pallet thing—something that's always bothered me."

"How so?" I asked.

"Well, remember when we talked about the release-pallets back at Station Equator? I told you about the *V10* part of the alphanumeric for the tropical and semi-tropical releases being really weird. And we didn't talk about it, but wasn't it just juicy-swell that the *TR7* releases meant for Wonderworld did so nicely there at Station Equator? And now it turns out that the TP4 and SA3 release-

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pallets we've been using—and the life-suspenbay is *loaded* with them—are just perfectly right for Station North and vicinity—"

"A coincidence," I offered. I was playing devil's advocate again.

Both Sarah and Sibyl gave me cold looks. Well maybe *they* understood what was going on, but I didn't. Not everything, anyway. "What are you driving at?" I asked.

"It's obvious," Sibyl said. "The Colony Syndicate people knew Symmetria absolutely cold. No pun intended," she added, as David looked across the rec room to the frosty viewport and started to chuckle. "The *V10* stuff," she resumed, "was designed very specifically to propagate ahead of the tides; but it wasn't intended to be used for, maybe, hundreds of years. We scuttled their plans by taking Plymouth to Station Equator rather than some station north or south."

I was with them now, and the logic was compelling. The Colony Syndicate had gotten our money plus all the lucrative government per-head subsidies and they needed a place to dump us. Wonderworld—at least as we perceived it—didn't exist. So they did what they had to do, and here we were on Symmetria. Maybe other colonists would show up later. I wondered what kind of story they'd have been given.

Anyway, things could work out after all. Sibyl and I would get the challenge we thought we wanted. And the fact that the Syndicate loaded on the tropical and semi-tropical releases at all meant they figured that someday we'd be able to cope down there. I visualized us branching out from Station North, making forays south as a circle-ocean moved on, planting, harvesting, hunting and moving north again as the next circle-ocean approached. Over the years, maybe the centuries, we'd move further and further south as we learned to cope with the lineament cliffs and the tides. Maybe we'd even become seafarers. Maybe—

Rowland Graves walked in, and I motioned him to sit down. Sarah and Sibyl told him their thinking. He was even more skeptical than I had been, but he asked the right questions and quickly started to piece everything together. Rowland is a different person these days. He's less the nitpicker, much more the leader. Saving everyone's life by getting Plymouth airborne had given him a good case of self-confidence. Just exactly what he needed.

He'd been the Syndicate-picked leader before, but after we got to Station North we all *voted* him the job. That was only right, considering how he'd performed that day of the waterfall and the great tidal flood. There were good reasons why the colonists hadn't bolted to the lake on that fateful morning and good reasons why Plymouth had been able to get away at all after I radioed my warning. And all the reasons had to do with Rowland Graves. He'd been waking up and keeping after his people that whole blessed night before the tidal flood struck, giving them assignments "just in case we have to get away *fast*," and making certain they were ready to deliver on those assignments. Even so, getting Plymouth airborne in time had been an iffy thing.

Rowland and I get along remarkably well these days. He uses me as a kind of right-hand man, says my impulsive-

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ness and risk-taking approach to life balances his conservatism and over-planning. I could have come out of all this villain or hero. On the villain side of the ledger, I was the chief culprit in taking Plymouth to Station Equator in the first place and my name could have been "mud" for almost getting us all killed. But Rowland speaks up for me when it counts and takes the blame for going to Equator on his own shoulders. That leaves the hero side of the ledger: me giving the alert to get Plymouth in the air before that wall of water hit. So *hero* is kind of how I'm regarded now. I try to keep it in perspective.

We like to think that we control our own destiny, and certainly we do to a point. But as I look back on everything that's got us to where we're at now, it seems like intelligence, good planning and hard work have been balanced in equal measure by pure, dumb luck. I wonder if the future will be any better managed. ■

●Our only hope is corruption. As long as corruption lasts, lenient judgments will continue and even the innocent may get off scot free.

Bertolt Brecht

●We should be careful to get out of an experience only the wisdom that is in it—and stop there; lest we be like the cat that sits down on a hot stove-lid. She will never sit down on a hot stove-lid again—and that is well; but also she will never sit down on a cold one anymore.

Mark Twain

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Jeff Hecht

GLOBAL CATASTROPHES AND MASS EXTINCTIONS

What would happen if an asteroid or a comet hit the Earth? Most science fictional seekers of the Apocalypse have chosen different ways to end civilization, but impacts are high on nature's list of potential global catastrophes. The pockmarked surfaces of the Moon and Mars show that collisions can happen, and affect large areas. Most earthly craters are less obvious, but geologists have found dozens of impact structures, such as the 70 kilometer (44 mile), 200 million year old crater now filled by Lake Manicouagan in Quebec.

You wouldn't have to be at ground zero to suffer from such an impact. It would raise a huge cloud of dust that might linger for months in the atmosphere, blocking the Sun and cooling much of the globe. Its energy would shock-heat air, converting nitrogen, oxygen, and water into a deadly nitric-acid rain that might be as strong as battery acid. A water impact might raise a gigantic tsunami. One in a forest could ignite a giant forest fire. The global effects could exceed those of an all-out nuclear war.

It would take a tremendous impact to kill all life on Earth. The oldest traces of living cells are more than three billion years old, so such events seem highly unlikely. However, rocks also record times when life on Earth changed dramatically. In comparatively short periods, plants and animals that dominated the Earth vanished, to be replaced by new species in a sudden burst of evolution. The best known of these mass extinctions was marked by the death of the dinosaurs 66 million years ago.

Scientists are trying to understand the causes of such mass extinctions. Could a stray asteroid or comet have done the deed? Or did something else, like massive volcanic eruptions, cause a global catastrophe? Was that event unique, or has fate reset the evolutionary clock many times with great disasters that killed what had been the world's most successful species? Could seemingly random catastrophes cause mass extinc-

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tions and shape the course of evolution? We know that impacts can happen, that whole groups of plants and animals can die off at the same time, and that widespread extinctions affect the course of evolution. The circumstantial evidence is suggestive, but the complex mysteries are worthy of a Sherlock Holmes, and the scientific jury is still out.

Too Much Iridium

The story opens a decade ago in Italy. Geologist Walter Alvarez and his physicist father, Luis, were curious about a 66-million-year-old clay layer marking a major geological transition, between the Cretaceous and the Tertiary periods. That was the time when the last dinosaurs died, and when many marine organisms also became extinct. They pooled their talents; Walter found samples, and Luis analyzed them with sensitive instruments at the Lawrence Berkely Laboratory in California. Their curiosity paid off in an "iridium anomaly." Rocks from Italy, Denmark, and New Zealand contained 20 to 160 times more iridium than similar rocks deposited at other times.

Iridium is one of the platinum group of metals. It's very rare on the Earth's surface, but more common in asteroids. Assuming that the extra iridium was spread over the whole Earth, the Alvarezes calculated that it could have come from a 10 kilometer (6 mile) carbonaceous chondrite asteroid.

Such asteroids exist, and a few come close to the Earth's orbit. An impact would have been catastrophic. The Alvarezes estimated it would have dug a crater 100 to 200 kilometers (60 to 120 miles) across. It would have ejected material weighing 60 times more than

Dark Diagonal stripe in the clay layer which marks the boundary between the Cretaceous and Tertiary periods, exposed along a highway near Gubbio, Italy. The 50 Lira coin is about 2 centimeters (4/5 inch) in diameter. Concentrations of iridium and impact-produced spherules are highest in the center of the boundary clay. (Courtesy of Alessandro Montanari)

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the asteroid into the atmosphere. Some dust would stay in the air for years, blocking sunlight and cooling the Earth dramatically. The darkness would stop photosynthesis, so plants would die and animals would starve. Many species on land and sea would have died out completely—which did happen at the end of the Cretaceous.

The Alvarezes proposed their theory in the June 6, 1980 issue of *Science*. Many reporters seized on the idea, but geologists and paleontologists were skeptical. Most geologists were instinctively wary of the catastrophe theory because geology did not become a science until theories based on a gradual change replaced those that attributed fossils to the biblical flood. Moreover, the Alvarezes did not have conclusive proof. On top of the list of missing evidence was a crater of the right size and age. The fossil record was too fragmentary to tell if everything really died at the same time. Most of the Alvarezes's evidence was distinctly circumstantial, and some was based on shaky assumptions and rough calculations. Yet the Alvarezes were solid enough citizens of the scientific community to get a hearing.

A mountain of new evidence has accumulated, but the debate continues. Most geologists now think something catastrophic happened at the end of the Cretaceous, but it may not have been a single asteroid impact. Many paleontologists think the dinosaurs may have been on their way out—if not already gone—by the time the catastrophe arrived. Bits and pieces of seemingly contradictory evidence keep appearing. Some researchers believe other mass extinctions follow different patterns; others think the extinctions may be periodic.

The Great Crater Mystery

It didn't take long for geologists to assemble a long list of potential impact structures. Dating them has taken much longer, but it has at last yielded results. Mick Kunk of the US Geological Survey dated a crater buried under 30 meters (100 feet) of glacial fill near Manson, Iowa at 66 million years, putting it within a million years of the end of the Cretaceous—right on target, by geological standards. Other evidence also suggests the impact was in the middle of North America. The problem is that the Manson structure measures only 29 by 40 kilometers (18 by 25 miles), much smaller than expected, and too small according to many researchers. However, most estimates of crater size assume the object hit the Earth head-on. Other angles are possible. Peter H. Schultz of Brown University and D. E. Gault of the Murphys Center of Paleontology in Murphys, CA say an oblique impact would produce a much smaller crater, but still vaporize tremendous amounts of material.

The same dating technique has ruled out another promising candidate, a pair of craters on the Kara peninsula in the Soviet Union which are somewhat bigger than Manson. They apparently were formed by one object which split just before impact—but they are close to 75 million years old.

Some geologists believe there may

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have been multiple impacts, caused either by a barrage of small objects or the fragmentation of one large one. C. J. H. Hartnady of the University of Cape Town suggests one large object may have struck a glancing impact south of the equator, where India was at the time. One fragment might have landed in Iowa; others might have formed other craters. The whole process could have taken less than an hour, causing far more damage than a single impact at Manson. Others disagree.

Failure to find a suitable crater on land does not rule out an impact. About two-thirds of the Earth's surface is ocean. A few craters are known offshore, but others may be hidden by sediment. Some could be gone forever, because subduction has destroyed much of the ocean crust that existed 66 million years ago.

Evidence scattered around the Caribbean Sea and Gulf of Mexico suggests an ocean impact in that area. Joanne Bourgeois of the University of Washington has found deposits in Texas formed at the end of the Cretaceous by a giant tsunami, which could have been produced by an impact in the Caribbean. A rock layer up to 45 centimeters [18 inches] thick in Haiti contains an iridium anomaly and tektites, tiny chunks of glass produced by an impact, says Florentin J-M.R. Maurrasse, of Florida International University in Miami. Maurrasse has found other impact debris in eastern Cuba, Jamaica, and the Dominican Republic.

Geologists are not sure how the Caribbean looked at the end of the Cretaceous, but plate tectonics has shuffled the map enough to destroy a crater. No obvious craters lie exposed on the surface, but a 210-kilometer [130 mile] ring structure lies buried under hundreds of meters [over 1,000 feet] of limestone along the Yucatan coast. It apparently was formed by an impact near the end of the Cretaceous, says Alan Hildebrand of the University of Arizona, who tracked down the authors of an obscure 1981 report which mentioned the structure. Hildebrand and others have proposed other sites, but so far the best bet is the Yucatan crater, named after the nearby village of Chicxulub—"the devil's tail" in Mayan—by its discoverer, Houston geologist Glen T. Penfield.

Charles Officer and Charles Drake of Dartmouth University suggest a different catastrophe, massive volcanic eruptions, could have caused both the extinctions and the iridium anomaly at the end of the Cretaceous. Like an impact, volcanic eruptions can generate huge quantities of dust to obscure the Sun, and produce toxic gases. Officer and Drake even have a site, an area called the Deccan Traps in India, where massive eruptions deposited over a million cubic kilometers of lava 66 million years ago. Massive volcanic eruptions occurred in Siberia at about the same time as the mass extinctions which ended the Permian period about 250 million years ago, says W. Jason Morgan of Princeton University. However, other great eruptions are not associated with mass extinctions.

The most serious problem for vol-

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canists is that key components of the boundary clay are missing from eruption debris. The Deccan Traps contain only 0.026 parts per billion iridium. Carl J. Ortho of the Los Alamos National Laboratory says that's too little to cause an iridium anomaly, but volcanists argue that the iridium might have been emitted as a gas. A more serious problem is posed by tiny crystals of quartz with flaws created by shock waves. A volcanic explosion can produce some defects in quartz, but probably not the multiple shock patterns seen in quartz grains from the end of the Cretaceous. Further evidence for an impact is the discovery at the boundary layer of unusual amino acids present in asteroids but not in terrestrial materials.

A few researchers try to combine impacts and volcanism, suggesting an impact might trigger massive eruptions, or form a volcanic "hot spot" like those that built Iceland and the Hawaiian Islands. The simplest mechanism would be punching through the Earth's crust to expose the molten inner layers, but computer simulations by John D. O'Keefe and Thomas Ahrens of the California Institute of Technology indicate that the shattered crust would flow back to cover the hole. Tom Simkin of the Smithsonian Institution in Washington suggests that an impact might trigger a magma chamber ready to erupt.

The scientific jury has yet to return a verdict, but at the moment the evidence seems to favor an impact at the end of the Cretaceous. However, that does not mean that impacts are the only things that could cause mass extinctions. Nor does it prove that a wayward asteroid or comet killed the dinosaurs.

Are Catastrophes Regular?

The Alvarezes's iridium anomaly got scientists thinking about other mass extinctions. Some plotted extinction rates over the last 250 million years, and found peaks about every 26 million years. Jack Sepkoski and David Raup of the University of Chicago say the 26 million year period fits best for the most recent—and best-dated—100 million years. (The last big extinctions were 17 million years ago, so we're safe for a while.)

Many geologists are not convinced the period is real. Stephen M. Stigler and Melissa J. Wagner, statisticians at Chicago, think the geologic time scale itself has a statistical bias toward a 26-million-year period. Others say statistical analysis of random dates would yield some apparent periodicity.

The biggest problem is that periodic extinctions should have a common cause, which is far from clear. Richard A. Muller of the University of California at Berkeley suggests the Sun has a faint red-dwarf companion that approaches the Solar System every 26 million years. That close passage would eject comets from their orbits beyond Pluto, causing some to shower down on the Earth. However, a systematic search has yet to find that faint star, dubbed "Nemesis," and many astronomers doubt that its orbit would be stable.

The volcanists have their own idea. David E. Loper of Florida State Uni-

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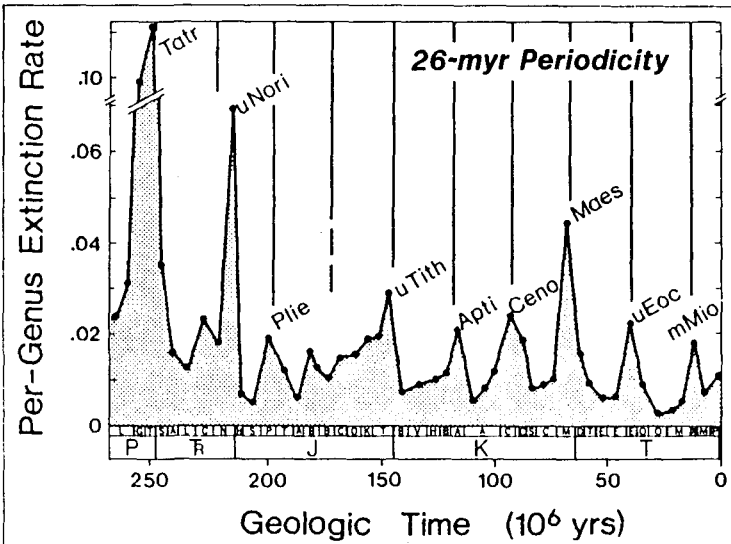
versity and Kevin McCartney of the University of Maine at Presque Isle suggest a molten layer between the Earth's core and mantle becomes unstable every 20 to 30 million years. They believe the instability comes as the layer thickens, until eventually molten rock bubbles to the surface, producing a hot spot and perhaps volcanic explosions. Like boiling water, the bubbling would be irregular, but the average period is in the right range. Volcanists including Officer like the idea, but others remain skeptical.

Some evolutionary biologists suggest the period may reflect the rate of evolution. Many species grow more specialized with time. This helps them succeed in a constant environment, but leaves them vulnerable to change. The longer they evolve, the more specialized they become—and the more vulnerable to extinction. Eventually, after a period that averages 26 million years, the environment changes enough to wipe out the overspecialized species, and start the whole cycle again.

Ironically, if mass extinctions are caused by periodic impacts, they probably would not fit the pattern seen by



Extinction rate for the past 250 million years, showing peaks about every 26 million years. The biggest extinction was at the end of the Permian period 250 million years ago, labeled "Tatr" on the chart. The second highest peak, "u Nori," marks the end of the Triassic period. The extinction at the end of the Cretaceous, which wiped out the dinosaurs, is the third highest peak, marked "Maes." From J. J. Sepkoski Jr., 1988, "Periodicity of extinction: a 1988 update," pp. 170-171 in *Global Catastrophes in Earth History: An Interdisciplinary Conference on Impacts, Volcanism, and Mass Mortality*, Lunar and Planetary Institute, Cont. 673

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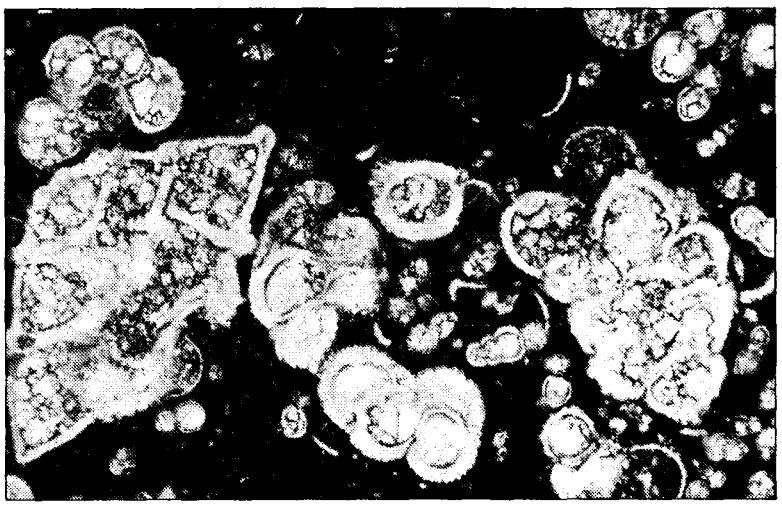
the Alvarezes. Asteroids would hit the Earth randomly, as the planets perturb orbits of objects crossing the Earth's path. Periodic impacts are most likely to be comet showers, yet comets have much less iridium than asteroids. That means a comet would have to be much larger than an asteroid to account for the extra iridium at the end of the Cretaceous. Such a huge object would have made an even larger crater, causing more severe effects than calculated by the Alvarezes. Yet many species managed to survive whatever happened at the end of the Cretacous.

Another problem for periodicity is that all mass extinctions do not carry the same geological signatures. Researchers have found other iridium anomalies, but not all of them match mass extinctions, and many mass extinctions lack iridium anomalies. Could different objects have hit at different times? Or did different geological events trigger similar ecological catastrophes?

What Ended the Cretaceous?

It's not even clear exactly what happened at the end of the Cretaceous period. Careful analyses show that the boundary clay is not uniform around the globe. The relative concentrations of isotopes, the amounts of iridium, and the distribution of iridium through the strata all differ. A few studies show iridium peaks in older sediments, perhaps caused by other impacts up to 100,000 years earlier. Some scientists suspect two or more impacts may have ended the Cretaceous, but geologists know of no way to tell if multiple impacts happened the same year. A worldwide layer of soot on top of the boundary clay indicates that great forest fires may have



Tiny fossils show the effects of the event that ended the Cretaceous. Marine microorganisms at the end of the Cretaceous were large and varied.

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followed an impact or other catastrophe. Edward Anders of the University of Chicago says the soot is not present below the boundary, and that its carbon 13 content indicates it came from burning living plants rather than fossil fuel. He estimates the soot layer amounts to about 2% of worldwide forest mass, enough to block sunlight for weeks or months. Later on, carbon dioxide from the fire could have caused greenhouse effect warming. However, some other geologists say that soot is present in other layers near the boundary clay, and may have been generated over a longer time.

Geologists don't agree on all the evidence. The best records of life on Earth are preserved in ocean sediments, so most extinction statistics are on marine life, especially microorganisms. J. Smit of the Free University of Amsterdam found "no significant progressive changes" in microorganisms over a million years before the sudden events at the end of the Cretaceous. However, Gerta Keller of Princeton University claims some organisms died out in a series of steps. Smit found tiny, glassy spheres in the boundary layer, apparently droplets of rock, melted by an impact, which solidified in the air. Their composition resembles that of ocean crust, which he calls "compelling evidence" of an ocean impact. His isotope analysis shows surface water warmed about 10°C (18°F) after the impact. He blames the warming on a greenhouse effect caused by carbon dioxide released after many plants and animals died. Keller thinks the extinctions happened over a longer period, and remains unconvinced that an impact was the only cause.

Whatever ended the Cretaceous did not wipe out everything in the ocean. Few deep-sea organisms became extinct at the end of the Cretaceous, says Ellen Thomas of Wesleyan University. However, many died out at a later time when little changed on land.

Land plants in western North America were evolving rapidly near the end of the Cretaceous. Kirk R. Johnson and Leo J. Hickey of Yale University say many species became extinct at the end of the period. They blame most of the fatalities on long-term environmental changes, such as the drying up of a sea that covered central North America. However, other paleontologists say fern spores become unusually common right after the end of the Cretaceous—as if ferns sprouted quickly after a catastrophe devastated other land plants—and about a third of land plant species became extinct.

Evidence for catastrophic extinctions of land animals at the end of the Cretaceous remains shaky at best. Except for dinosaurs, most North American vertebrates survived relatively unscathed, say J. David Archibald of San Diego State University and Laurie J. Bryant of the University of California at Berkeley. From a sample of over 100,000 identified fossils, they extrapolate that up to 86% of common species survived, although they concede that the actual survival rate may have been lower. Archibald says the extinctions "do not appear to be attributable to any single cause, catastrophic or otherwise."

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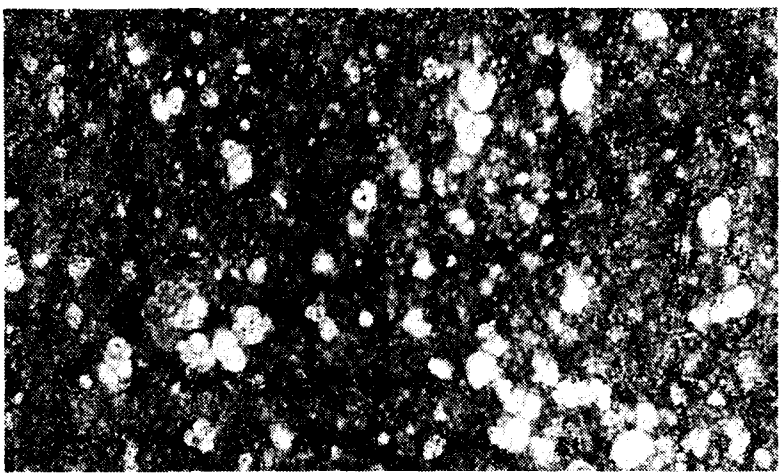
Dinosaurs were not common in Archibald and Bryant's sample, and the number of species had been dropping for a few million years before that. In fact, Archibald says, few—if any—dinosaur fossils have been found within two meters of the boundary clay, and the last dinosaur may have died before the end of the Cretaceous.

Other vertebrate paleontologists share Archibald's view, but theirs is a hard case to prove. Very few animal remains are fossilized, so the fossil record is very fragmentary. Even a common species may leave only a few fossils a million years or more apart. If a species left one identifiable fossil each million years, there's a 50-50 chance it would leave none in the last 500,000 years before it died out. That statistical sampling effect makes it hard to tell exactly when anything becomes extinct. Some scientists joke that the only conclusive proof of the impact theory would be a meteorite on top of a dinosaur skeleton.

It's also worth noting that many important uncertainties remain because the fossil record is very incomplete. Archibald's identified samples did not include any birds or pterosaurs, the flying reptiles of the dinosaur age. No one knows if birds suffered mass extinctions at the end of the Cretaceous, and the fossils needed to tell the tale may not exist. Likewise, no one is sure when pterosaurs died out. Their remains are few and far between, and none are known to be younger than 66 million year. However, no one knows if they died before, at, or even after the end of the Cretaceous.

Extinctions are not the only way to measure catastrophes. It might seem more logical to use a "body count" that told how much of the planet's biomass was killed. Unfortunately, paleontolo-



Only a few tiny species survived into the Tertiary.
(Courtesy of Alessandro Montanari)

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gists don't know how to measure that directly. Small changes in the ratio of carbon 13 to the more abundant carbon 12 in sediments can indicate changes in biomass, because most metabolic processes use carbon 12 more efficiently. Kenneth J. Hsü of the Swiss Federal Institute of Technology in Zurich says that global biomass productivity remained low for 500,000 years after the end of the Cretaceous, in what he calls the "Strangelove Ocean." Similar isotopic anomalies occur at other mass extinction times, but that does not directly give biomass.

Other Mass Extinctions

The Alvarezes firmly tied their iridium anomaly to the end of the Cretaceous. However, the geological record includes other mass extinctions, and evidence of other impacts, including iridium anomalies and tiny chunks of natural glass apparently formed when an impact melted surface materials. Some impact evidence comes at times of mass extinctions, but most do not.

The Alvarez group at Berkeley found excess iridium in sediment deposited near Antarctica and New Zealand 10 to 11.7 million years ago. The two sites are 10,000 miles apart, so deposition of that much iridium would indicate the impact of a 3-kilometer (2 mile) asteroid. Some extinctions occurred at about the same time, but the dates may not match, and the iridium deposits themselves may not be the same age. Some excess iridium has been found in deposits about 90 million years old, at the time of a minor mass extinction, but again the precise dates are uncertain.

Other impact evidence is not even close to mass extinctions. Iridium anomalies and glass spherules deposited 37 to 39 million years ago in the North Atlantic do not match known extinctions, but the wide distribution of the spherules indicates some impacts were large. And another study showed no iridium anomaly at that time in the central North Pacific.

Meanwhile, no one has found iridium at the times of the two biggest extinctions of the past quarter billion years, the end of the Permian 250 million years ago and of the Triassic about 200 million years ago. The Permian ended with what Everett C. Olson of the University of California at Los Angeles called "the greatest extinction of all time." Great amounts of lava erupted in Siberia. Yet Carl J. Orth of the Los Alamos National Laboratory found "absolutely no iridium" at the end of the Permian.

Likewise, no one has detected iridium or shocked quartz at the end of the Triassic. There was no massive volcanism then, but an impact is possible. The Manicouagan Crater in Quebec is about the right age—but it lacks iridium. Deposits from the end of the Triassic are scarce, but specialists who have studied them are not convinced the extinctions were catastrophic and sudden.

A Complex Puzzle

Scientists have yet to reach a consensus on the cause of mass extinctions. It is clear that asteroids and/or comets can hit the Earth, devastating vast areas, if not the entire globe. The effects of impacts have not been well quantified. Researchers have suggested aftereffects

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including massive nitrogen poisoning, blocking of most sunlight and a bitter cold "impact winter," global acid rain, and dramatic warming from the sudden injection of vast amounts of carbon dioxide into the atmosphere. The combination sounds deadly enough to kill all life on Earth, but some plants and animals survived.

In reality, all the estimates of climatic effects—like those of global warming today—are rough, and subject to large errors. Crater size clearly is not the only variable. If the Manson impact ended the Cretaceous, why are its effects so much more obvious than those of the Manicouagan impact, which produced a much larger crater? The angle of impact, the type of object, the season, the impact location, and the nature of the target rock all must play some role. Wind patterns, temperatures, precipitation, and other crucial atmospheric conditions likewise were important, and all are hard to quantify.

A single impact might cause a global catastrophe only if accompanied by another disaster or environmental stress. An impact might not have wiped out the dinosaurs 100 million years ago, when they were diverse and abundant, but it could have killed the few remaining at the end of the Cretaceous. Added to other environmental stresses, like changes in sea level, massive volcanic eruptions, or another impact, an otherwise tolerable impact might push the world over the threshold of global catastrophe.

The possibility of global catastrophes gives us plenty of room to speculate. Might dinosaurs still rule the Earth if a wayward asteroid had not collided with the planet 66 million years ago? Or, even more intriguing, might random impacts have shaped the course of life on Earth? Suppose that—as proposed by Stephen Jay Gould of Harvard—evolution is not a gradual and continuous process, but mostly occurs in a series of steps, called punctuated equilibrium. Life evolves to take best advantage of a stable environment, changing only slowly as sea level and climate shift gradually. Catastrophes could change the rules dramatically, wiping clean large areas of the evolutionary slate, and giving new opportunities to previously obscure plants and animals. Mammals, for example, evolved rapidly into many new forms after dinosaurs left the scene at the end of the Cretaceous.

Can We Prevent Catastrophe?

Could an impact add *Homo sapiens* to the roster of global catastrophe victims? Certainly impacts are still possible; Eugene M. Shoemaker of the US Geological Survey in Flagstaff, Arizona estimates 1,100 objects at least two kilometers (1.3 miles) in diameter cross the Earth's orbit. Halley's comet is about 10 kilometers (6 miles) in diameter, the size of the object that the Alvarezes said ended the Cretaceous.

In the early 1980s, the NASA workshop headed by Shoemaker concluded that each year there was a 1 in 300,000 chance an impact would destroy civilization. They did not define that as killing every human being on the planet, but as wiping out a year's worth of agricultural production and pushing mankind back to the Dark Ages or even the Stone Age—like any number of science

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fiction disaster novels. The result was never published, and the estimate was admittedly very rough. Participants acknowledged that such an impact might happen anywhere from once in 10,000 to once in more than a million years.

As if to remind us of the danger, on March 23, 1989, a previously unknown half-kilometer (0.3-mile) asteroid missed the Earth by about 640,000 kilometers (400,000 miles), one of the closest approaches on record. Nobody saw it coming, because it approached from the direction of the Sun, with its dark side toward us. Astronomers working with Shoemaker discovered it only after it had sped by. When they calculated its course, they found it crossed the Earth's orbit, and would have hit the planet if it had come along six hours earlier, says Henry Holt of the University of Arizona. The asteroid was big enough to form a crater 8 to 16 kilometers (5 to 10 miles) in diameter—not a global catastrophe, but certainly the greatest disaster in human history.

What can we do about the impact risk? The first step is to find and track objects that pass near us, so we can calculate their orbits. That would tell us what objects are dangerous, and warn us long before an impact when and where it would occur. The task has only just begun; Clark R. Chapman of the Planetary Science Institute in Tuscon, Arizona says we have discovered only 5% to 10% of Earth-crossing asteroids larger than a kilometer or two (about a mile). Even smaller objects could have "pretty profound effects," he says, and tracking them would take even more effort.

In a book titled *Cosmic Catastrophes* (Plenum, New York, 1989), Chapman and David Morrison of the University of Hawaii recommend building a dedicated telescope for a 10-year observing program. If the program found nothing dangerous, we could stop worrying —although it would be wise to keep watching, in case planetary encounters changed some orbits, or sent new objects into the inner Solar System.

If an object was going to hit the Earth, at least the program would predict where, so the target area could be evacuated. An ocean impact is more likely, but that would require evacuating regions of coastal zones, where gigantic tsunamis would wipe out everything.

With enough warning, and an adequate space fleet, we might prevent an impact. Careful application of nuclear weapons should deflect a large asteroid so it would miss the Earth. Enough nuclear explosives might shatter a small rocky asteroid. As clumps of ice and cosmic dust, comets should be much easier to destroy.

It's much too early to know if any asteroids or comets are bullets with our names on them, but the idea of a cosmic disaster prevention patrol has a certain charm. At one stroke, it would justify more investment in astronomy and space, and give the world something constructive to do with its overgrown nuclear arsenal. The need to prevent a common doom might help bring nations together. Perhaps we need to invent an asteroid threat lest we go the way of the dinosaurs. ■

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Marc Lopesh listened to the Queen of the Night as the stars crawled slowly by, winking out briefly when eclipsed by the invisibly black supports of the opera theater dome. He could not interest himself in the too derivative brooding set or the too usual raggy costumes, but let the timeless music flow through his mind, a gentle background to his memories.

Behind and above the darkened stage lay the ghostly globe of Venus, starlight and corona reflecting from the dry ice plains and nitrogen pools, but not so bright as to wash out the glories of the Milky Way. The full Earth would do that in a few months.

Every second, the neon glow of a man-made shooting star flared out from the center of the disk, always eastward, taking its load of carbon dioxide to Mars and the asteroids. Behind him lay the great sunshield, the largest thing ever made by man. It was only a black disk from here at the counterweight station, taken for granted.

Looking at Venus, most people thought of the far future, some three thousand years from now, when the ice would be gone and the real work of terraforming began. But Marc's thoughts went back a decade, to a close brush with death and love. Katrina in his arms once, Katrina in his mind forever.

"It's time to go now, sir." A bright voice pulled him back from the past. He realized the opera was over, and he and the young usher were the only ones left in the vast dome. "Did you enjoy it?" she asked.

He smiled ruefully. "Very much, though perhaps not in the usual way," he told her. She was outrageously beautiful, he realized, slightly wavy shoulder-length tresses framing a warm wise face graced by a pert, just slightly upturned nose. Wide set, large, deep brown eyes lent an elfin cast, and the simple black cotton top metamorphosing to a long clingy skirt below the unadorned belt did nothing to disguise the lithe body of an athlete or a dancer.

"I know you weren't sleeping, but you seemed to be, well, elsewhere. Mozart can do that to people, I know. But there seems to be something more for you." A knowing smile.

"It brings back memories, every time I'm here; memories." She didn't seem to be in any hurry, so he continued. "I used to work down on the surface, and someone I knew there liked opera. We lost track of each other, but I come here to remember her."

"I'm Maria Theresa," she opened, with a faint Germanic accent and a surprisingly firm hand to shake, "and I'm new here. My parents came to study large scale power transmission for a few years. Then they're going out to the belt to work on Beamrider." Beamrider would be the first fast interstellar probe. Robots did just about everything these days except make big decisions, so she must be from an important family. "But this seems very exciting too. And so, well, so romantic, to be working on something which will take so long."

"Well, I think so. Uhm, if you're free, I'll be glad to tell you about it. Are you hungry?" He delivered his line smoothly, just like he expected something other than another cold shoulder.

"Famished. I skipped dinner and

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came right here from Williams." A college student then, not jailbait. This sort of thing didn't happen, he thought, not to an ordinary guy approaching forty with an ordinary lack of grace, lack of hair, and lack of exercise. Of course all truths were statistical, and he must have been here a hundred times before without saying as much as hello to anyone.

"Where should I wait for you?" He asked. She had, he remembered, started by asking him to leave.

"The lobby stays open for tourists, and they have some really nice comfy chairs out there. I'll be right along: it should take me about ten minutes to close up. Then I'll be right with you." She laughed at the expression on his face and touched his arm. "Really. You can trust me."

It was more like twenty minutes, and the last ten left him thinking about there being no fool like an old fool. But then she came, flowing out of some inner sanctum, poised and happy. The brighter light, if this was possible, increased her beauty. She saw him notice her the way men notice beautiful women, and their eyes met. He felt embarrassed and she smiled even more.

"I dance." And she did, spinning around a couple of times, holding her dress in one hand, caressing the air with the other, ending by moving everything in a long sensual writhe followed by a gentle curtsy. She gave no hint of modesty about her talent or her figure. Just pride and grace.

She took his hand, and they walked to a small lounge about a kilometer spinward of the opera dome and ordered a plate of sausage and chicken fingers with a bottle of lunar white Zinfandel.

"So tell me how we made Venus into an iceball," she asked, mouth full, eyes sparkling.

"Well," he started, "it used to be a good approximation of hell down there. . . ." He described the original Venus, with ninety atmospheres of carbon dioxide over volcanoes, rocks and sand baked to over twice the absolute boiling point of water.

Then came the project. Mercury had provided the material for the sunshield, magnetic ore hoppers riding electric launch rails past escape velocity and braking in the hundred kilometer tracks laid in trusswork across Venus L1. He explained how the factory at L1 made the reflectors and solar pumped masers which, knitted together, comprised the twenty thousand kilometer sunshield; how the optics were designed to reflect more sunlight if the sunshield moved away from Venus, pushing it back to her embrace, and less if it got too close.

"The L1 point is gravitationally unstable along the Sun-Venus line," he reminded her and noting her look of concern, he added, "but with its passive optical system, the sunshield position is stabilized by light pressure. So don't worry, we aren't going anywhere if someone turns off the wrong switch." He had her wide-eyed complete attention, and guessed that her parents had somehow managed to pass their own space enthusiasm on to her, no mean feat in this age where everyone had the option of robot-fed indolence.

He told Maria how, without sunlight, Venus abandoned her heat to space, every square meter of her glowing like an infrared lamp. She had cooled until, within a decade, traces of water and

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sulfuric acid had rained from the sky, became vapor again by stealing the torrid warmth from her skin and feeding it to the hungry void. The carbon dioxide itself had snowed from the sky, and finally nitrogen lakes had graced her lowlands.

"I'll bet it was stormy," Maria gushed, "thunder, lightening, and tornadoes!" She made circles with her hand high in the air as if to suggest thunderheads, her face gleaming with an intense, almost evil delight. The unworthy thought occurred to him that young Maria Theresa might be too much of a good thing.

"At thirty thousand meters," he qualified the cataclysm. "At the start, the winds moved much more slowly at the surface, where the air was still so dense. Then, in just a couple of hundred years it got cold enough for the carbon dioxide to snow. When all of that condensed, we built the CMR, circumaphrodisian maglev railroad, that's what CMR stands for, that we see below us, and started flinging megatons of dry ice away from the planet every second."

"Aphrodite is the Hellenic name for Venus, I know." She chimed with a mischievous grin. "I've seen pictures of the CMR from the surface. It seems so, so ethereal, like it was floating. Those fairy towers hardly seem strong enough to keep it aloft!"

"They aren't. Actually what they do is tie the CMR down. On its fast track, the hoppers move much faster than orbital velocity. They keep the railroad at altitude by centrifugal force as the dry ice below gets cut away and stuffed into hoppers by billions of robots. So, in three thousand years, Venus will be rid of her snow.

"Not only that, but the CMR pushes Venus in the other direction as it accelerates the hoppers. When we're done, a Venus day will be down from half an Earth year to about six weeks. Its rotation period will be longer than that relative to the stars, but remember Venus is a woman, and turns the opposite way to all the male planets. Ah," he held up his hand to stop her protest, "Earth doesn't count, and we're not really sure about Uranus."

"I go both ways, too," she laughed. "So tell me more about how you got along with Venus. You didn't let the robots do everything?"

"We couldn't wait. When the pressure got low enough, we established a colony on Maxwell Montes, not because the robots couldn't do things just as well, but because, well, those of us who had worked so long and hard at this couldn't wait three thousand years to walk on the surface. Of course we usually didn't walk, we skied." Katrina had been a really good skier.

"I liked to ski in Austria-Hungary, but always cross country, not down mountains. If I broke a leg, I couldn't dance." Maria's grin, and the light in her eyes suggested something more.

"That would be a shame," he agreed. "Anyway, the atmosphere snowed down for months. Finally the surface pressure was down to a few atmospheres and a lot of that was nitrogen, argon and neon. Up on Maxwell, the snow came and went and there were occasional clear spells. Sometimes you could see the stars.

"I'd met this meteorologist, Katrina,

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and invited her to go check on a remote station with me. The stations were automatic, of course, but with people on Venus, they all had a bunk room and survival supplies. It was about twenty kilometers there and back, good exercise, and lots of privacy overnight." He gave a shrug of the shoulders which he hoped would look worldly.

Maria Theresa gave him a knowing nod and moved over beside him, arms and thighs touching. "Tell me more," she encouraged. Marc had to take a breath and finish his Zinfandel. He ordered another bottle from the booth's comm unit and stumbled through an explanation of how Katrina and he had made a bracing, but uneventful trip out and had a bracing, eventful night in.

"You should not be so shy about something so beautiful," Maria chided him when he waffled around the nighttime activities. She was eager for more detail, shamelessly pressing his thigh, and wearing the same expression of unholy glee she wore when describing thunderstorms. He sought safety in a diversion.

"There was a funny problem between us," he told her. "Back then, my favorite music was jazz-rock, classic Chicago revival, trombone punk, that kind of thing."

"Oh." Maria nodded seriously.

"But Katrina was deep into Hayden and Bach," he continued. "Our colony's classical station was featuring Mozart that night, and so that's what what we used to cover those distracting pump noises and the squeaks that you always get in that kind of setup. We could have compromised on Gershwin or E. Min Sung, but she was on a mission to educate my musical tastes. I survived; everything worked without woofers helping."

"Hmm, you should try Bolero," Maria kidded him. "I have the classic version on stick."

"Maybe," he temporized. Do they know what they do to you when they drop hints like that, he wondered. "Anyway, the next morning we set out to return. About halfway there, Venus had a surprise for us. It stopped snowing."

They had been joyful, he recalled, to see all the stars, the atmosphere suddenly clear from horizon to horizon. Clouds still billowed below the mountains, gleaming in Earthlight bright enough to cast a shadow. They had stopped to admire the sight.

"When we went to move, we found our skis were encased in dry ice. Then we realized what had happened. The pressure had dropped enough that vapor couldn't form, and inverse sublimation had replaced the snowfall. The dry ice was growing up right out of snowpack. If we had waited a moment longer, we wouldn't have been able to break free. As it was, Katrina's binding cracked and slowed her down."

An understatement, he reflected. She had been able to lurch forward at a little less than a kilometer per hour. At that rate, it would have taken them about twenty hours to reach the base, skis sticking every time they were planted.

"Ach! And here you are to tell about it. Couldn't the colony have sent a vehicle for you?"

"The base and the vehicles were having their own problems. Nothing had predicted such an abrupt transition. Air-

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bots were crashing. The surface temperature was dropping very rapidly without the cloud cover, and things were icing up instantly. Nothing could move and the dome itself was iced in. We had radio contact, but we had no choice except to keep moving. The worst problem was that with the greater effort and the slower progress, our suit power and oxygen would probably give out. It looked hopeless, but we had to try."

He described how, to help keep them going, the radio stations had kept playing their favorite selections, interspersed with words of encouragement from everyone of note on four planets and in the space between. They'd made about half the distance when, exhausted, Katrina had moved her foot the wrong way and the binding had broken for good.

"She said it was her fault, that she was the meteorologist and that she should have anticipated what would happen when the pressure got too low for liquid carbon dioxide to exist. She told me to leave her and come back and dig her out. But we both knew that wouldn't work. She couldn't walk: without the skis to distribute the weight, you broke through the crust, sank and foundered in the powder below.

"I managed to break my skis free and move back to her, cracked the ice off the binding on her other ski, released it, and got her into a fireman's carry. I had to shift my backpack around to the front to do it, but fortunately the tubes were long enough to allow that. I was exhausted by the time I got my skis free again, but I was able to move."

Somehow, he told Maria, he had gone on for an hour, lungs burning, arms and legs aching every step. Katrina had promised to marry him if he learned to like Mozart and Mendelssohn on the way. The Hebrides Overture seemed to match his slogging pace, but did nothing for his spirits. Tired and short of breath, he had asked someone to dig up some hard jazz.

"Katrina managed to do something with the straps and hoses so her weight wasn't on my neck and I could move my arms. That helped. Then the guys on the radio got the beat going and my whole mood picked up. They put the music stick in the hole and let the good times roll, as they say. I managed another twenty minutes when she said that there probably wasn't any hope for me if that junk was what kept me going and that she was going to turn down her volume and try to sleep. That irritated me because I was doing all the work, but I didn't say anything. I had to concentrate on sliding one foot in front of another."

"I guess everyone has their limits on music," Maria agreed, "but I dance to all sorts of stuff. Anyway, you must have made it because here you are." She looked very smug and anticipatory, as if she had in mind that they both be somewhere else soon.

"Well, I didn't. I must have gone another couple of hours, but I got tired. And sore. Every muscle I had was aching. I managed to release my ski bindings and tried to shake her awake. 'Katrina,' I croaked, 'this is the end of the road for me. You'll just have to use my skis. Maybe you'll have a chance.' But she didn't answer.

"I tried to get her down off my back. The tubes sort of pulled on me, and I

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discovered that she must have switched air supplies with me about the time she went to sleep. Mine must have been almost out already, but she'd been using a lot less than I had. That lift I'd gotten wasn't due to the change in music alone.

"But by then I was too tired to do anything but lie down, with her still on top of me. I'd never felt so good in my life. I don't even remember being cold before I fell asleep."

"That's horrible," Maria sympathized. "But you were still alive."

"Barely. When I woke up a month later, they told me that they'd spotted Katrina's helmet light strobing through a couple of centimeters of dry ice and hacked us out. Someone had come up with the bright idea of using electrical heating tape on their skis, and they'd redirected one of the sunscreen power masers to heat the skin of the colony dome, right through the ice. It fell off and a rescue party skied to our last position. The suits are smart and they preserved us just long enough; rationing every last joule of energy. I only lost a couple of toes."

"Oh, I'm sorry." Maria touched him again with that knowing look. "But what about Katrina?" She asked.

"They sent her back to Earth, still comatose, before I woke up, weeks later. I couldn't even remember her family name until I looked up the report. It was Schmidt. Do you realize how many Katrina Schmidts, Ekaterina Schmidts, and so forth, there are on Earth? And I didn't have any official authorization to override the world system privacy safeguards. I couldn't find out where she went. The project wasn't too helpful either. Our little escapade was a romance on invented business and project time. They'd just as soon everyone forgot about it. I was lucky I didn't lose my job along with my toes. I got busy, dated here and there. I really meant to follow up when things died down. By then it was too late. A mutual friend told me she'd found someone else. Forty million kilometers would be a long distance romance, anyway."

"Oh, that's sad," Maria sighed. "But now you come to the opera hoping she's come back to Venus and you might run into her?"

"Oh, I guess I'll always have that hope in the back of my mind. But, realistically, it's just to remember. And, well, my musical taste seems to have changed. I don't go to hear hard jazz anymore. It hurts me now. I suppose, in a funny way, I'm trying to prove myself worthy of her by my change in listening habits."

Maria looked at him in a worldly sad way, as if she had just lot something of great value, or had to make a hard choice; the way a mother looks as her son leaves home for space.

She sighed and put her hand on his arm again. "Tell me what she looked like."

"Well, she was about your height, but thinner. Intense. Blond. Strong face with high cheekbones. Slavic or maybe Nordic. A little scar over the right eyebrow, a souvenir of college chemistry which she never bothered to do anything about; she called it her merit badge. Ah, you're a lot more, well . . ."

"Compliments will get you anywhere." Maria laughed, and kissed him, long and full, oblivious of any onlookers. But she looked sad, wistful.

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"But we must go somewhere else to see the proof, no?" she teased, and got up from their booth. He followed, heart pounding, but not knowing what to expect.

They went another kilometer spinward through the entertainment section, watching the passersby become progressively more informal. They neared the Bicentennial Club, and he felt a moment of nostalgia for the days decades ago when this was all new; before he went to the surface. Before Katrina.

But Maria did not take him to the parklike main entrance with its miniature beer garden. Instead she used an electronic keycard to open a nondescript door in the corridor nearby.

Suddenly, he found himself in a backstage world of bustle and confusion, theatrical objects, spotlights, flats, ropes and cheerfully busy people in various states of dress and undress. Most of them seemed to know her. Onstage, a number of near naked dancers were writhing to a pounding seven-four beat, brass hitting dissonant augmented fifths on three and seven, bass and woodwinds walking through in a semi-melodic riff. The Real stuff. The number faded with people lying all over the stage as the lights dimmed. They got up and ran off in the dark.

"Hi, Maria." A cheerful nymph addressed them, grabbing a sweatshirt. "Can't stay away?"

"Never. Kelly, Marc. Told him I danced, so I thought I'd show him. You look good, sis."

"Uh, thanks," she bubbled. "Hi, Marc. Well, have an eyeful, but you get a better view out front. Our next bit is really spectacular, though I don't do it anywhere near as well as Maria."

Overwhelmed, Marc smiled dumbly. There was nothing he could think of to do or say. Somehow he had been expecting Maria's dancing to be ballet, but again, perhaps that was not wholly wrong. What he'd seen was forthrightly sexual, but it was not bump and grind.

"Maybe we'll see about that," Maria laughed. "The Cat in tonight?" she asked.

"Front left as usual. Want to take a turn for me? I'll be happy to watch the mouse." Kelly bumped her hip into Marc and laughed.

"Maybe later, kid. See you. Come on Marc." She led him through another side door to a corridor which led to a side entrance near the stage. They went in among the din of intermission, Maria taking him to a table, stage left nearest the door.

The woman sitting there was heavier than he remembered, though still fit, and her hair was streaked with white, naturally it seemed. But it was Katrina. It took her a couple of seconds to recognize him.

He forgot about Maria as their faces went from astonishment to joy, expressions rehearsing the words they would later share, when they could think of them.

But, before anything was said, Katrina rose, embraced Maria fully and kissed her. Then Maria Theresa, smiling at them wisely, eyes bright with tears that might be the kind one has at weddings, or perhaps at funerals, put Katrina's hand in Marc's. She curtsied as she had for him only a few hours earlier and danced lightly back up to the stage. ■

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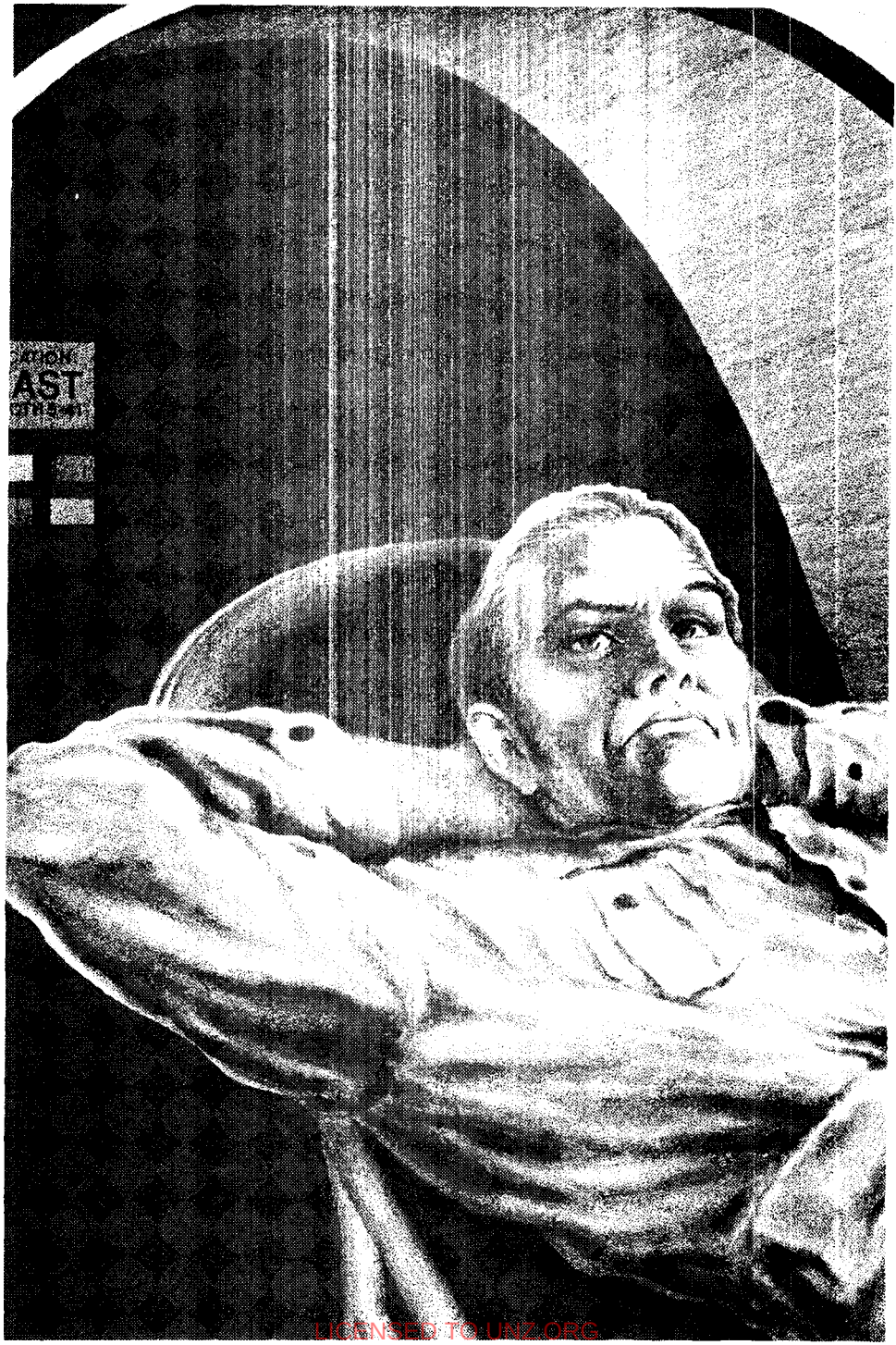

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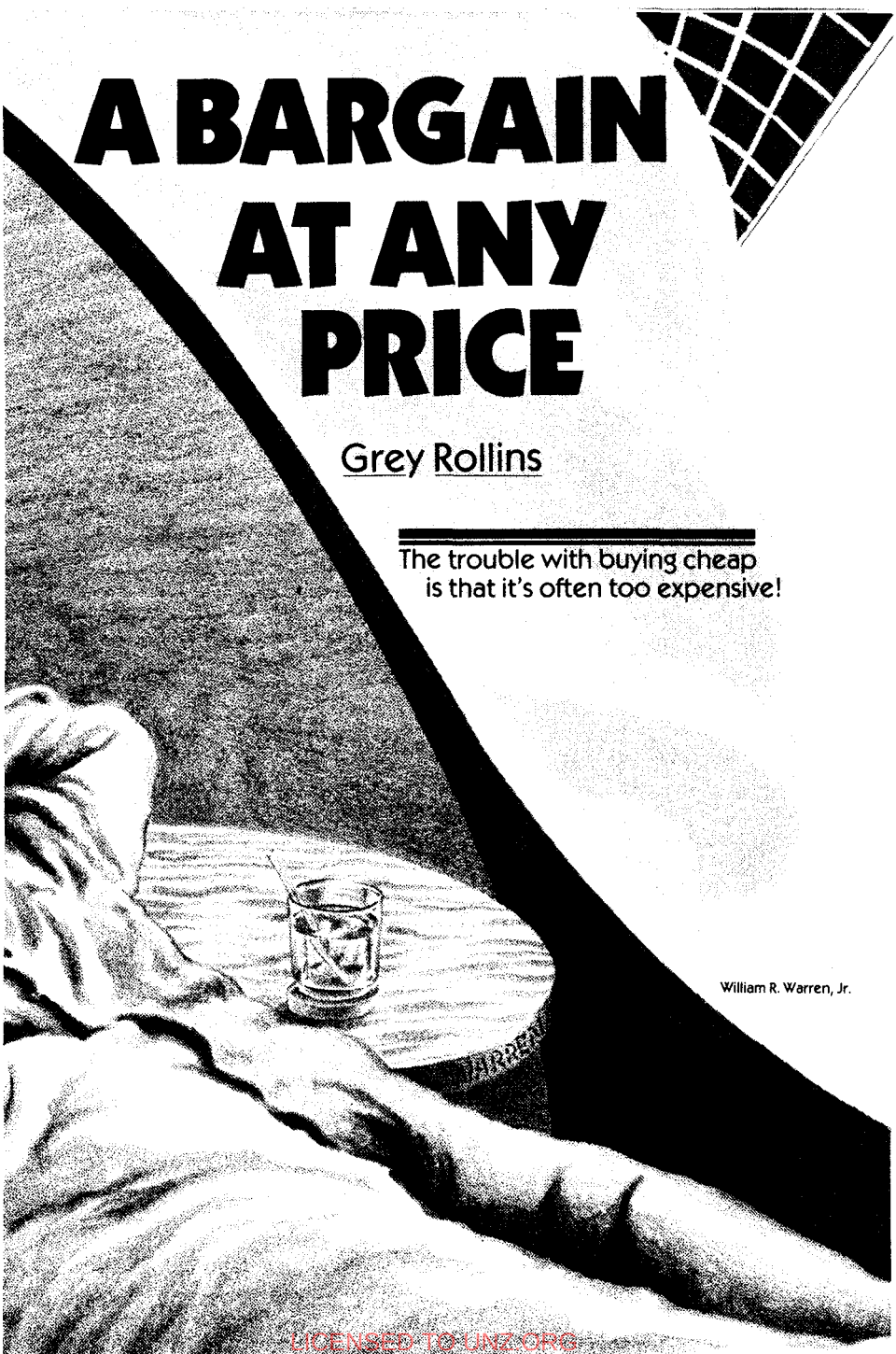
A BARGAIN AT ANY PRICE

Grey Rollins

The trouble with buying cheap is that it's often too expensive!



William R. Warren, Jr.

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Jane had left just a week before. For good this time; she was now living across town with the second assistant vice president in charge of toilet paper at one of the banks. I wasn't exactly feeling all that good about it.

Colors were flat and lifeless, everybody mumbled, and my tunnel seemed too empty. Being dumped is not high on my list of favorite things in life.

I was wandering through the shopping district that surrounds the big atrium in central New London. The one that all the tourists say reminds them of the malls back home and why had they come all this distance just to see another mall? That's just before they pull out their billfolds and go on a shopping binge. *Plus ça change, plus c'est la même chose.*

I wanted something to drink, so I went up to the second level where there's a small stand owned by a man with no legs. He lost them blasting out the space where the atrium is now. I try to give him all the business I can. If we don't support the people who made our life-style possible, we'll go down the tubes.

"Good evening, Mister Brinkman. What can I get for you?"

I tried to smile, but it slid right off my face. "Pepsi, I suppose."

He cocked his head and looked at me carefully. "Bad day, Mister Brinkman?"

"Bad *life*, Kenny."

He nodded knowingly. "Woman troubles. I see it all the time." He shook his head and sucked at his teeth. "It's not good having too many men for the number of available women. Makes for problems. Someone should do what my great-great-grandfather did and start a mail-order bride service." His eye glinted as he smiled at me. "Mark my words, anyone who did that would be rich as Croesus within a week!"

Kenny's great-great-grandfather had done damn near everything but invent the wheel . . . and I more than half expected to hear about that feat next week.

While he was talking, Kenny had been sliding his seat back and forth along the aluminum rail that runs the length of the service counter. It was a great deal more practical than having to maneuver his wheelchair in such a cramped space. He spun back around from the drink dispenser and set my cup before me. "What else can I do for you tonight?"

"That will do it, Kenny."

"One fifty-seven."

I counted change and passed it over to him. "Thanks."

His eyes bored into me. "Listen to me. I've been around a while . . . paid some dues." He slapped his left stump with his free hand. "I won't tell you that life is wonderful, because it isn't. Sometime it downright reeks. What I want to say is that in spite of the fact that things don't look too good to you right now, it will get better, I promise—and I never go back on a promise."

"Yeah," I replied, "I'll remember that."

"OK, Mister Brinkman, here's what you do. Go back down to the first level. Find an empty booth where you can spread out and relax. Then I want you to lean back and stare through the dome up there and get lost in all those stars.

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It won't make the pain go away, but it will give you some perspective."

I almost told him no. I had intended to go straight home after getting my drink. God knows where my life would be now if I had done so. Instead, I thought about it for a second and nodded, as much to myself as to Kenny. "Sounds good, Kenny. I'll do it."

I threaded my way through the crowds, back to the broad, sweeping stairs that linked the first and second levels. Forcing myself to walk slowly, I kept my head up and watched all the people surrounding me, the bright holo signs in front of the stores, the huge, shiny mobiles that swung slowly, ponderously in the air currents. There were two booths that were empty at the moment. One was where Kenny could see me. I took that one so that he could see that I was following his advice.

The atrium in New London is five levels high, in which, with typical human illogic, the usual level numbering system is reversed. Normally, the levels in Lunar cities begin with level one nearest the surface, and increment as you go down. It seems counterintuitive at first, but it saves having to renumber all the existing levels when a new lowest level is completed. In the atrium, purely for the hell of it, level one is at the bottom and level five is at the top, just below the surface. I guess it's that way so that the tourists won't get unnecessarily confused.

Originally the atrium had been a high-class residential district, but one by one the businesses had moved in. Now there were probably less than thirty private residences left. One by one, the remaining owners were succumbing to the lure of the mid to upper six figure prices being offered for their modest tunnels.

Up at the top of the atrium is the biggest maintenance headache known to man. A large dome of glass or plastic—I don't know which, as I've never bothered to ask. But I *have* heard about the problems that they have keeping the gaskets from leaking our air out into the endlessly greedy vacuum of space.

Keeping it clean? Don't ask. Sometimes conditions cause the humidity in the air to condense on the underside, leaving hazy streaks as the rivulets trickle down to the gutters.

Tonight, however, I was free just to lean my head back against the padded seat and look out. It was night both inside and out—about nineteen local time and Lunar night outside. The dome must have been cleaned recently because the stars looked as though they were staring right back at me. Small diamonds, each with an individual spotlight directed at it alone, just to make it shine.

Twenty minutes I stared at those stars. When I lifted my drink to take a sip, the ice had melted and watered it down. As Kenny had promised, though, I felt somewhat better.

I looked up at the second level balcony and waited until I caught Kenny's eye. I waved and he nodded and I slid out of the booth, not yet ready to go home, but unable to sit still any longer.

Having already walked the first and second levels, I rode the elevator to the third. I would have walked up the stairs had there been any, but that improbable fantasy stairway only connects the first and second levels.

Jewelry stores, clothing stores, even

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a small pet store, although I didn't know anyone who owned a pet here on Luna. I walked slowly around the balcony. Then I took the elevator to the fourth level.

The overly cute names and the relentlessly brightly-lit store fronts began to run together in my mind. To give myself some perspective, I stopped and leaned on the rounded edge of the parapet and watched the people far below. I amused myself by trying to guess how far down they were. It would have been easy to drop a coin or one of the few remaining pieces of ice from my cup and time the fall, but I didn't want to hurt anybody. My best eyeball estimate was twenty meters, although I later found that it was more.

Turning, I resumed my walk around the fourth level, trying desperately not to let my mind get back into the rut of thinking about Jane. The colors of the holos blurred together and all I saw were soft-edged blobs of color. I wasn't really paying attention to where I was walking.

I started violently when an androgynous voice spoke right at my elbow. "Good evening, sir."

Thinking I had inadvertently brushed against someone in my dazed frame of mind, I turned and prepared to apologize. There was no one there.

Just a speaker.

Feeling faintly foolish and irritated at having been ready to apologize to a speaker, I studied the thing more closely than I would normally look at a mere box.

"Watch your drink, sir!" the speaker said.

I straightened abruptly. This time I really did bump into someone. He had been standing behind me. I turned and made ready to be polite, but stopped when I saw that it was a salesman.

He had that bland, characterless, mall-worker kind of face. "It meant that you were about to spill your drink," he informed me.

"Oh. Thanks," I grumped.

"That's version 2.3 of our Living Home software." The way he said it you could clearly hear the capital letters.

Damned if I didn't do something I *never* allow myself to do in a mall. I showed interest.

"Perhaps you aren't familiar with our Living Home package?"

Mutely, I shook my head. I wouldn't have been standing there at all if the stupid thing hadn't spoken to me. Scared me, it did.

"The Living Home package is the latest product in our new line of accessories for the modern home. . . ." On and on he droned in his artificially inflected mall-voice. Once he started talking, I couldn't get him to quit. For that matter, I had a difficult time even finding a place to stick in a single word.

Eventually, I got a bit impatient. "You mean this program will make my tunnel's computer alive?" I demanded.

"Oh, no sir, this program *emulates* consciousness. . . ."

Christ, I'd gone and gotten him started again. This time I half-listened, vaguely interested in spite of myself.

After what felt like hours he ran down. For all I know, he had to trot in back and get his spring rewound, but I wasn't going to give him the chance. I'm allergic to canned sales spiels.

"Thanks," I muttered and walked away, thinking that people who work

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in malls are surely a different breed from the rest of mankind.

All his incessant sales chatter kept running in circles in my mind. Boiled down to its bare essentials, it seemed that I had slept, like Rip Van Winkle, through the greatest revolution in computer software since assembly language.

A couple of nerd types down on Earth had actually gotten around to writing a program that made a computer self-aware. Conscious, in every sense of the word. It had been in the news for ages—Major Growth Industry.

Where on Earth had I been?

On Luna, actually. No excuse; it had been in the news here too.

There had been science fiction stories about it as far back as I could remember. Now they had actually gone and done it.

Amazing. Good for them.

At any rate, variants of this new type of program were being used in anything and everything. Here in New London they were being used to automate the tunnels. I vaguely remembered having heard that some folk had been buying new programs for their tunnels, but I hadn't been able to see what good it would do me. I already had some perfectly good software in my computer. At least, I assumed it was good—it had come with the tunnel when I bought it and seemed to do a perfectly competent job of handling the finer points of running my tunnel for me.

The mall-drone had gone to great pains to explain to me the difference between the programs that were actually self-aware and the ones that only emulated consciousness.

In a word—money.

The ones that only *seemed* to be alive were cheaper. After that he had lost me. If it seemed to be alive, then how the hell did they tell the difference between it and a program that was *really* alive?

In typical mall-slippery-talk, he had turned my question against me. "Exactly! Why pay all that extra money for a consciousness program that is indistinguishable from our Living Home software!" I could tell that I was going to hear those damned capital letters even in my dreams.

Nightmares, more likely.

While my tired ears were ringing with the echoes of that marathon sales pitch, my feet had kindly taken me home. To my new home, that is. It was a relief to know that my feet were already programmed for the new tunnel instead of taking me back to my old one.

I had only lived in my new tunnel for a month. Jane and I had picked one in the newest residential area. Ultra modern—they didn't call it a suburb in the sales literature, they called it an *upburb*—a clearly manufactured word that was a little too cloying for my tastes. It was on the third level, nominally a desirable place to live, but, by definition, it was out away from the center of the city. Fine by me. I was ready for some quiet.

As a matter of fact, I had been ready for marriage, but Jane wasn't. *Poof* . . . no Jane.

I slid my entry card into the lock and walked in. Hell, the place even *smelled* new. I still wasn't used to it, but I liked it. A lot.

Except when Jane wasn't there.

I got up the next morning after having

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thrashed my sheets throughout the night. Had Sheet Strangling been an Olympic event, I would have been a major contender. The top sheet lay in defeated knots and wads on the other side of the bed, not daring to move, lest it attract my attention and risk being pummelled within an inch of its life.

Breakfast was the best meal of the day—best in the sense of least bad. My subconscious didn't expect Jane to be there. She had always been up and gone before I got out of bed, since her schedule started earlier in the day. Not that it mattered what her schedule was any more.

In the funny associative way that the human mind works, thinking about my subconscious led to consciousness, and that, in turn, led to remembering the sales pitch from the night before.

Ugh. To think that I had let myself get suckered into listening to all that meaningless blather. I hated myself for not having walked away as soon as I had heard the first unctious words slither out of his mouth.

On the other hand, I had to admit that it would have been nice if my tunnel had spoken to me when I had come in. It would have made the place seem a little less empty. The tunnel seemed not only lonely, but sterile. It was still too new—it needed some kind of humanizing element to make it a little warmer. Lived in—homey.

I went out the portal and headed to work still thinking about the Living Home program.

At least it was better than brooding about Jane.

By the time I got home from work that afternoon, I had perversely talked myself into taking a second look at the Living Home program. I hated myself for being even remotely interested, but the idea of something—anything—that could make the tunnel seem a little less empty held a strong appeal.

Even knowing that I would probably get reamed by my current, no doubt transient, obsession made no difference. I still wanted my tunnel to speak to me when I came in the portal after a hard day at work. I wanted to be able to call home and see if I had any messages waiting. I wanted to have my breakfast fixed without having to lift a hand—ready to eat by the time I fell out of bed. For that matter I could sleep another ten; maybe even twenty minutes each and every morning if I didn't have to do my own cooking. Ah . . . luxurious thoughts of sleeping late!

No better than I had been sleeping since Jane left; the idea of sleeping twenty minutes later in the morning was ludicrous. I was lucky if I could get a total of twenty minutes sleep during an entire night.

The fact that my tunnel was already capable of doing over half of the things that the Living Home program could do was irrelevant. Somehow the sex appeal of having a conscious tunnel—even if it only *seemed* conscious—overrode the rational part of my mind. I was well on the road to hell before I even thought about reading the street signs.

"Good evening, Mister Brinkman. What'll it be this time?"

"Ahhh . . . let's go for a root beer tonight, Kenny."

He grimaced. "Sorry, the pressure

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line burst late this afternoon and I won't be able to get a new one until in the morning."

"OK, Pepsi then."

He nodded. "That I can do easily enough." He whirled his seat around and slid to the drink dispenser. As the cup was filling, he turned and spoke over his shoulder. "You look a little less upset this evening. I'm glad to see it."

I managed a grin that didn't fall flat. "Better tonight, for sure. Star gazing last night was a good idea."

"I don't normally see you two nights in a row. Going shopping?"

"Well, in a manner of speaking. I'm going to look at this Living Home thing up here on the fourth level." I hooked a thumb pointing directly upwards.

Kenny's face screwed up. "Yeah, I've heard about it. Nothing I have any use for. If I ever get something like that, I'll save up and buy the real thing."

I shrugged. "Really, it's not that bad. I saw it last night and it looked kind of interesting."

I paid him and we made small talk for a few moments more. Then I sauntered over to the elevator and rode up to the fourth level.

This time I was prepared when the speaker spoke to me. I even got up my courage and mumbled something in return.

He was waiting for me. Mallman, himself.

Some small part of me shuddered and hid when he saw me and hastened over to where I was standing, but I did not heed the implicit warning. Visions of a fully automated tunnel had taken over and I was blind to anything else. Tunnel vision, so to speak.

"Good to see you!" The tone of his voice implied that we were old friends who hadn't seen each other in quite some time.

"I was wondering if you could run through your demonstration of the Living Home program one more time."

No question about it. Someone had grabbed the key, stuck it in his back, and wound him up to such a fever pitch that I began to fear for his sanity. It isn't healthy or normal to get that excited about computer software.

I watched and nodded and said yes at the appropriate places. He spoke to the machine and typed, and at one point even gestured silently at the plastic eye of the camera to get the computer to turn off the water, mix drinks, start the coffee, and answer calls. All the while, little animated icons danced on the screen, simulating the actions he was commanding. The water temperature in the bathtub or shower was guaranteed to be accurate to within one-half degree of my preset favorite temperature. Of course, the machine could handle up to six preset temperatures in case I ever was fortunate enough to get someone to live with me again.

Jane's ghost had a good laugh at that one.

By the time I left, he had worked himself into such a state that I doubted that he would be able to sleep that night. I still did not know his name. I didn't want to. Like consorting with the lowest of whores, I felt better not knowing any personal details.

By the next morning I had made up

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my mind that I would buy the Living Home program or bust. Some small remnant of rationality persisted in telling me that it was not necessarily a good idea to jump into something like this without knowing more about what I was doing, but I blithely ignored it.

During the day it occurred to me to check on the financial angle. How much was this little lark going to set me back?

It took me over ten minutes to remember the name of the stupid store. My mental image of the storefront kept blurring, melting, and reforming into any one of a dozen other, interchangeable, stores. Finally, I remembered that it was the Dandy Business Center. I had almost been afraid that I would have to walk over to the atrium on my lunch break and look. That would have been humiliating.

After this cerebral breakthrough, I got the number from the directory and punched the number into my desk terminal. I sneered at the lowly thing. *You aren't conscious. You can't even* emulate *consciousness. If you were running Living Home, I could just* tell *you the store I wanted to dial and you would do it for me!* Technological chauvinism knows no bounds.

The woman who answered had a voice so seductive that it made velvet seem abrasive by comparison. My eyes jumped to the screen of their own volition. What kind of heavenly apparition owned a voice like *that?*

There was no visual. I was crushed.

"Um, my name is Brinkman. I was in last evening looking at your Living Home software and I had a few questions . . ."

"Just a moment, sir. Let me get your salesman for you."

Helen may have launched a thousand ships with her face, but this woman was fully capable of launching a million with her voice. I was on the point of asking her out for dinner when that all too familiar voice came on the line. "Mister Brinkman! What can I do for you today, sir?" Somehow, though the words were nearly the same as the ones Kenny used when he greeted me, the underlying shallowness made them faintly nauseating.

"Oh . . . hi. How did she know to get you?"

He laughed. "I told her that you might have some questions. So when you told her that your name was Mister Brinkman, she knew who to get. By the way, my name's Ron. What can I do for you today?"

We went round and round for a while, but it seemed that it was not going to be as expensive as I had feared. That's not to say that it was cheap, but it was something I could afford without having to take a second job. I told him I'd think about it and broke the connection.

I spent the rest of the day fantasizing about the woman who had answered the phone. Lunar social situation be damned—I was going to get a look at her. As long as she didn't look like Attila the Hun's grandmother, I was going to ask her out.

I had the grace to nod to Kenny as I walked by, but I didn't stop to get a drink. I was headed up to the Dandy Business Center on the fourth level.

Ron was waiting by the Living Home display when I walked in. He had

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known to the second when I would arrive. Nothing like the smell of a big commission to sharpen a man's sense of timing.

Before he could even launch into his routine, I asked, "I meant to ask you this afternoon . . . who *was* that on the phone? She has one helluva voice and I'd like to meet her."

There. I'd flown full in the face of convention and taken the initiative in meeting a woman, even if I had to enlist Ron's help to do it.

Ron's face went blank for a moment—of course, it wasn't that much of a change from his normal expression. Then his face puckered as though he was making a mighty effort not to laugh at me. "Mister Brinkman, that was the Living Home program. There wasn't really a woman on the phone."

I stared at him, then at the Living Home display. "You mean this thing sounds like *that* on the phone?"

Well, to make a long story short, it turned out that somehow he had neglected to tell me about the optional voice modules that you could buy. It didn't have to sound androgynous. I could have that luscious voice in my tunnel.

Well, that was almost as good as meeting the real flesh and blood woman. The idea that I could have that voice all to myself, all the time, was as much as I could stand.

Then Ron explained how there was a software parameter that I could set that would cause the voice to have various accents. The amount of the accent could be varied as well, from just barely noticeable to so thick you could stir it with a spoon.

To demonstrate, Ron chose a French accent and ran it about midway up the scale. Enough to give her a lilt, but not so thick that it sounded as though she had just gotten off the boat. Chills ran up and down my spine. Just the thing for a lonely man.

I paid in cash.

For all that money, they only give you a box the size of your fist. Three chips and one of those itty-bitty twenty gigabyte diskettes. On a weight basis, computer software makes gold seem like a bargain.

The directions were quite clear. Pop the service cover off of the CPU and install the chips in option sockets five, six, and nine. Then run the installation diskette.

No problem, right?

Wrong.

The chips went in easily enough, but when I tried to run the installation diskette, the lights went out. Hardly what I had had in mind for an automated tunnel.

I pulled the diskette out by feel and rebooted the system. The lights came back on immediately. Relieved, I bent and studied the chips. God forbid that I should get them in the wrong sockets.

They looked OK, so I put the installation diskette back in and tried again. This time the ventilation system shut down. As near as I could tell, it was in emergency mode—meaning that it thought that there had been a catastrophic pressure drop and it had sealed off my tunnel to keep me from dying of explosive decompression.

The only problem was that there had

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been no pressure drop. I was now in danger of suffocating in my own tunnel.

I pulled the diskette out and booted the system again. The air duct opened up.

When all else fails, read the directions—even if you've already read them twice. Maybe I had missed something.

By the time I gave up and went to bed that night, I had read the directions so many times that I could recite them from memory—including copyright notices and other miscellaneous fine print. I had tried the installation process no less than seven times. Each time some bizarre, unpredictable thing would happen. It was never the same thing twice.

Ron turned the chips over in his palm. "They look OK to me. Let's see what Charles has to say."

Charles turned out to be a tall, slightly pear-shaped man with glasses. He saw it immediately. "Ah. Here's your problem. This is the wrong chip. See here where it has the part number? This should be an oh four nine, instead it's a seven seven two."

I frowned. "But how was I supposed to know that? The directions said to install the chip with the blue square in the corner in socket number nine. They didn't say anything about the part number."

Charles shrugged good-naturedly. "It's not your fault. Somebody just screwed up at the factory, I guess. We'll give you a new chip set."

Before leaving, I made them check that the new chips were the right ones. They were. All was well.

All was *not* well.

The chips went in just fine. The installation process looked as though it ran properly. At least all of the messages that came up said reassuring things.

Then I tried to tell the computer to turn on the water in the kitchen sink.

Music began to play.

If I told it to make the tunnel warmer, the lights dimmed romantically—at least there was a sort of poetic logic to that one. If I asked it what time it was, the phone would automatically begin to dial my mother's number back on Earth. Seeing as how it was four in the morning down there, I had to get that stopped immediately. I would have had a hard time explaining to my mother that I, who don't call often enough to suit her anyway, had called her *by accident*. In the wee hours of the morning, no less.

I glanced at my watch. There was just barely time to call Ron before the store closed. I manually dialed the number and heard the voice from heaven again, if only briefly.

I described the situation to him. He consulted with Charles and about fourteen other people. As near as I could tell, he went out in the corridor and stopped shoppers as they passed and took a vote. I was on hold for ages—and I didn't even get to talk to the Living Home voice.

"Uh, Mister Brinkman, it sounds as though your computer might be defective. Have you ever used those control circuits before?"

"Only a few of them. The other program didn't use very many."

I could almost hear him nodding. "I see. Well, you'll need to get someone to check out your computer. It

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might have been defective all along and you just didn't realize it until now."

It never once occurred to me that even the circuits that I knew had once worked, the phone for instance, no longer worked properly. I simply sat on the floor and wished that I had had the wit to take a complete system backup before I started so that I could reinstall my old system and have a functioning tunnel again.

It was like camping out. I had to do everything by hand. Some things didn't work at all.

It was interesting, in a grim sort of way, to discover that I had no hot water. I thought about it for a few minutes, then put all the biggest pots I could find on the stove and heated my water that way. I'm accustomed to taking a shower in the morning, but an occasional sponge bath doesn't hurt me.

I didn't know who to be mad at, but I was damned well ready to be mad at *somebody*. All I needed was a focus for my anger. I found it in one Audrey Hamilton. She had the misfortune to be the one who picked up the phone at the computer service center that morning. At least at work I had reliable visual —back at my tunnel it had sputtered and died and would not so much as blink at me.

After I had blown her doors in for about five minutes, I had to stop and take a breath. With quiet grace, she managed to sneak in a question before I could get going again. "Mister Brinkman, where did you say that you got this software?"

"Dandy Business Center. Over in the atrium. The program is called Living Home."

"Oh."

The flat inflection with which she uttered that one word spoke volumes. The dead silence which followed it spoke even more eloquently. Finally, she sighed and said, "I assume that you are at work now."

"Yes, and if—" I was still pretty cranked and if she had let me get going, it would have been another five-minute tirade.

She was wise enough to know that, so she interrupted me. "Can you meet me at your tunnel on your lunch hour?"

"I'm afraid that I won't be taking a lunch hour today as I was late coming in to work. That was due to the fact that my tunnel has been degraded to the point where it has about the intelligence of a dog. I'm using my lunch hour to make up for being late." Sarcasm? Who, *me?*

She nodded. "I see. I hate to ask this, but is there any way that you can take some time off this afternoon?"

I almost let loose with another harangue, but managed by pure force of will to stop myself. I exhaled through my teeth. "I'll see what I can do. Can I call you back at this number?"

"Yes, sir."

It wasn't as hard to get the afternoon off as I had made it sound. I just wanted everyone who had anything to do with my tunnel's computer to know that they had an unhappy customer on their hands.

I got my desk cleared of all the most important things before I called her back. We agreed to meet at my tunnel in thirty minutes.

For some reason, even though we had had visual, it had not penetrated my

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thick skull that Audrey Hamilton happened to be a very handsome woman. It took seeing her waiting at my portal with the huge black plastic service kit at her side for me to realize it. Belatedly, it occurred to me that I might have made a little too much of an ass of myself on the phone earlier.

She didn't haul off and hit me, for which I was grateful, nor did she say anything nasty, although I was beginning to feel that I might deserve it. She simply picked up her case and followed me in. Patience incarnate.

"The computer is over there. Is there anything I can do to help?"

She looked at me as though she wanted to say something, but then she shook her head. My imagination supplied all sorts of nasty possibilities as to what she might have intended to say.

Sounding as humble as I could, I asked, "Would you like something to drink?"

"No, thanks."

I sat on the floor where I could watch her work. Jane had taken all the chairs when she left.

Audrey poked and muttered and prodded and cajoled and even cursed softly once or twice. Test instruments appeared from the depths of that voluminous black case. Leads snaked into the innards of my computer like multicolored vines.

After an hour, my backside was beginning to get a little sore. "What's it look like?"

She pulled back out of the CPU and shook her head. "Not good." She disappeared, only to come back out a moment later with a gray plastic rectangle pinched between her forefinger and thumb. "See this?"

I nodded. "Yes."

"This chip controls your I/O buss. Its idea of how to go about resolving a device address has become somewhat eccentric, to say the least. That's why you kept getting different problems when you were trying to install the software. The program *thought* it was talking to your heating unit—it was actually sending the controller impulse to the light dimmer. It could just as easily have been your telephone or microwave."

"So I wasn't going crazy, after all," I observed.

She shook her head. "Not at all. This little thing translates the computer instructions into impulses that the devices understand and makes sure they get sent out to the proper destinations. It was translating the commands just fine, but where it sent them depended on what mood it was in at the time." Sighing, she added, "I'm trying to see what else is wrong in here before I start replacing chips wholesale. This is going to be expensive."

"I just bought the tunnel a month ago. Isn't the computer new . . . still under warranty?"

Very slowly, almost sadly, she shook her head. "I'm afraid not. The warranty doesn't cover things like wrong chips being put in the option sockets. I know it's not your fault, but I doubt seriously that you'll be able to get Dandy to cover it." She reached behind her shoulder and patted the shelf that held the keyboard. "Poor thing." She sounded as though she had formed an attachment to my computer. Who was I to say she shouldn't?

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She threaded herself back inside the access cover and began to work again. I shifted my position. Even at low gravity, the human anatomy tends to complain if held against a hard surface too long.

The phone rang.

Audrey, her ear only a handsbreadth from the speaker, flinched and cracked her head against the top of the access hole. "*Damn!*" echoed hollowly from inside the cabinet.

"Can I answer it?" I asked sheepishly.

"I don't know, but for God's sake try, before this blasted thing bursts my eardrum!"

Just as I opened my mouth, I heard the dulcet tones of my French-voiced computer answer.

"Hellooo." Suddenly embarrassed that my phone had answered in a tone appropriate for the madam at a house of ill repute, I shrank back. Of all the things to still work . . .

There was a pause. "John?"

My mind went blank, but the rest of me responded purely on conditioned reflex. "Jane . . . Jane? *Jane!*"

"Hellooo," said my computer in the voice I had so carefully chosen.

"Who is this?" Jane's voice demanded, suddenly brittle.

"My name is Fifi. John can't come to the phone right now. May I take a message?" The word message came out sounding more like a massage.

I glanced towards Audrey only to find her staring at me in a most peculiar way. I couldn't have been more embarrassed if she had found an inflatable love doll in my closet. The night before, Fifi had sounded like a cute name for a little French mademoiselle with a voice like silk. Today it sounded sad and pathetic.

"Who the hell *are* you?" Jane cried.

"Why . . . I live here now," Fifi's voice responded. "Did you want to leave a message for John?"

With an inarticulate cry, Jane broke the connection. There was utter silence for a complete minute.

"Sounds as though you've got the telephone circuit working," I said lamely.

"Just incoming—that's why she couldn't hear or see you. From the look on your face, I'd say it was a good thing." Audrey looked at me carefully. "I know it's none of my business, but who was that, anyway?"

"I wanted to get married. She didn't. She left. End of story."

"Oh," was all Audrey said. She opened her mouth as though to say something else, but closed it and became very distant and businesslike. She reached into her bag of tricks and pulled out a clear plastic box full of chips. "Do you have a light that you can put over here?"

I fetched the only lamp I had left and placed it next to her on the floor while she prodded at the little plastic and ceramic bug-shaped chips with her fingertip. "Rats. I was hoping that I had another one of those chips in here."

"Which chip?"

She pointed back at the computer. "The I/O buss address interpreter/ translator—the one I showed you a few minutes ago. I'll have to go back over to the office to get another." She cranked her head around and asked the computer what time it was. It made no reply.

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"I thought I asked it what time it was earlier and got an answer," I said.

Audrey shrugged. "It's possible. At least three of the chips I've tested so far have been intermittent. There's no telling what will and won't work at any given moment. I hate to say it, but with that much damage I should probably replace the whole motherboard. There's no way to tell whether a chip that's functioning is OK or intermittent. It could easily stop working the moment I turn my back."

"How much will it cost to replace this . . . motherboard?"

She told me. I rolled over on the floor and stuck my arms and legs into the air. The cool plastic tile felt good against my face as I looked at her from my horizontal position. "My dear, if you would be so kind as to administer the *coup de grace*. . . ."

Audrey laughed. Not a polite, the-customer's-always-right laugh, but real, heartfelt. Her face went from being merely handsome to radiant. I knew right then that I was going to be in serious trouble if she was around for too long. Putting a lonely, newly single man in close company with an attractive, interesting woman is a sure recipe for trouble.

I sighed. "And to think that I was going to save money by buying a program that only *emulated* consciousness. For what this is going to cost me, I could have bought the real thing and had enough money left over to invest in the stock market."

Audrey laughed and started to make a flippant reply, but suddenly sobered and went iceberg formal again. "Mister Brinkman, I think I had better get over to the office and pick up that chip. It's getting late and I need to get at least a minimal system running on your computer so you can get through the night."

"Audrey, if it gets too late, I'll be glad to fix you dinner." Then I remembered that it might not be that simple. "Actually, we may have to go out to eat, but that's all right, I know this nice place down on level five, just off the atrium. . . ."

She had the same strange look she'd had earlier—as though she wanted to say something, but couldn't bring herself to do so.

". . . but if you don't want to, that's OK," I mumbled miserably. *Damn* these social conventions! Worse than the most virulent liberation movements. If you ask a woman out, she looks at you as though you're beneath contempt.

"Mister Brinkman, if this runs much later, I'd be more than happy to eat dinner with you."

"Really? Seriously? I was . . ." What I was doing was running at the mouth. Not smart, not impressive, not at all cool. I caught myself on the point of asking the computer what time it was and looked at my watch instead.

I took a deep breath. "Audrey, I hate to mention it, but it's after five already. Would you like to take a break and go out to eat now?"

She thought for a second, then nodded. "I guess so. I have a key card to the office so I can get in any time, even if they're closed. We can eat and then I'll get back to work."

I stood and helped her to her feet. "OK, let's go." Then my memory kicked in. "Actually, there is one *slight* problem."

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"What's that?"

"The manual release doesn't work. There was a part missing or something and the contractor promised me that he would have it fixed by last week. Needless to say, he didn't get it done."

"No problem. I'll just put the chip back in. Then the computer can open the door." She slid into my computer and was back out again in twenty seconds. But the portal still wouldn't open.

"Maybe the chip decided to finish drying," I suggested.

"Looks that way."

"Well," I asked, "how do you feel about cold cuts?"

The refrigerator was working, true, but it wasn't well stocked. Just standard bachelor fare. Nothing suitable for a romantic dinner with a woman.

Romantic? Did *I* say that?

We had worked our way piecemeal through the rest of my bologna, half a package of heat-and-serve rolls—cold, we couldn't get the oven or the microwave to work, a bottle of soda, and a few crackers. I debated for a long time before pulling out the *pièce de résistance*—a bottle of tolerable wine.

I raised one eyebrow questioningly. "Are you brave enough for dessert?"

"Wine? For dessert?" She paused and looked thoughtful for a moment. "In for a penny, in for a pound. Let's have dessert."

Glasses I still had. Jane hadn't thought that the ones I had were worth taking. I'll grant that they weren't fancy crystal or anything, but they held the wine admirably.

By the time the bottle was down to the punt, I had my head propped on one hand as I lay on my side. "You know what the best part was, Audrey?"

She was on her back staring at the ceiling. She rolled over to look me in the eye. "No, what?"

I chuckled. "Hearing Jane meet Fifi. You were quite right, I had no business answering the phone, but it was worth a bundle just to be able to hear Jane's side of the conversation."

Audrey's face lit up with a laugh. God, I had never met a more beautiful woman. For some reason I had never realized just how much laughter could illuminate a person.

She shook her head. "It's a pity that we didn't have video. The look on her face must have been choice." Audrey conjured a near perfect imitation of Jane's voice. "Who the hell *are* you?" As she said it, she twisted her face into such an expression of righteous indignation that I dissolved, absolutely helpless, in laughter.

Finally rolling back up onto my elbow, I was still breathing in gasps. "You're something. Did you know that?"

She chose not to answer. Instead she looked at me curiously. "When's the last time you laughed like that?"

"It's been a long time," I admitted.

"You're cute when you laugh."

"Cute?"

"You've got major league dimples. I like that. You need to laugh more often."

There wasn't a single thing I could think of to say to that. Half-afraid of how she would respond, I traced her lower lip with my fingertip. She smiled gently. I summoned up my courage and kissed her and, lo, she smiled again.

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In the end she spent the night. Not that she had any choice. The damned portal still wouldn't open.

She didn't seem to mind at all.

Which still left us trapped in my tunnel with no way out. Ranting and raving and threatening to sue the contractor for not having equipped the portal with a functioning safety override was futile. That didn't stop me from doing so, though. Futility is my forte.

Audrey accepted the whole ordeal with the same grace with which she had absorbed my hostility the day before. Eventually I was shamed into acting like a sane human being.

Once I simmered down, I set about making breakfast. At least, I scrounged up some edible odds and ends and we ate at about the time that normal people would be having breakfast.

I looked up from the last of the heat-and-serve rolls, cold of course, and said, "I had been putting off going to get groceries. Somehow it just didn't seem important."

Audrey chuckled. "Nothing unusual in that. It's a rare man who, when living alone, will keep a well stocked larder. This happens to be one of those times when fate catches up with you. Men like you grow so accustomed to having a woman in your life that some of the practical details of how to keep house never penetrate your skulls."

There was a slight sting of truth in what she said and I had to quell the impulse to say something starchy in return. "Guilty as charged, I suppose. Jane used to keep plenty of food around, even if her motives were purely selfish. I was an accidental beneficiary."

Audrey nodded to herself. "I see."

"You're different from all the rest of the Lunarian women I know. You don't seem to be quite so . . . perhaps remote is the word I'm looking for."

"Is that good?"

"From my point of view it is, but I'm prejudiced."

"I've only been up from Earth for about six months. I guess I haven't had time yet to absorb the local color." She sighed. "To be honest, I'm not sure I want to. There are some very good things happening here on Luna, but I'm not sure that they're worth the price."

I mulled this over for a moment. "You'll have to explain that one to me. I'm not sure that I understand."

She shrugged. "It's funny in a sad sort of way. I've always been good at things like electronics. Back on Earth men were always reluctant to admit that a woman could be as good as they were—much less better. It gets tiresome having to prove yourself over and over, John." She finished the last of her milk and looked up at me. "Anyway, I kept hearing that men and women on Luna were more equal than they were on Earth. One day I simply got fed up with the way things were going and filed for a transfer to Luna."

"That was six months ago?"

She gave me a strange look. "God, no. Ages and ages passed, but I finally got the transfer. The part where the story gets sad begins when I got here."

"Be careful what you ask for . . . you just might get it," I quoted.

She nodded ruefully. "Something like that. It's true that women here are more equal, but the funny thing is that I don't like it. Whether it's true for all

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women, I couldn't say, but in the last six months I've learned that all I was really searching for was to be able to get along in the business world as an equal. I wanted to keep being a traditional woman in my private life."

"And, of course, the social situation here on Luna has done more to upset a woman's private life than it has her business life," I put in.

"Some of the women that I know like things the way that they are now, but I swear I think that some of them feel the same way that I do. Somehow, we seem to have forgotten that what you do for a job is supposed to earn the money to allow you to pursue your private goals—not the other way around. Things have gotten twisted topsy-turvy."

"You said that some of the women that you work with feel the same way that you do—"

"My grandmother once told me what it was like when she was a young girl back in the seventies. The women's liberation movement was really big back then and there was a lot of peer pressure to act as though you agreed whether you did or not. I think that there's something like that going on here on Luna. It's not acceptable for a woman to want to be anything other than the aggressor — twenty-four hours a day."

"So what are you going to do?" I asked.

"God, I don't know. I wasn't happy on Earth and now I'm not happy here. Is there anywhere else to go? Is Mars open for colonization yet?"

I laughed. "Not that I know of. Besides, there's no telling whether you would feel at home there or not. It could turn out to be just as uncomfortable as Earth and Luna. Honestly, I can't say as I'm happy with the state of affairs, either."

This brought a hint of that wonderful smile to her face again. "Yes, I can see how men might feel a little uncomfortable with the way that things are here."

"I don't mind sharing space with a woman at work as long as she really is good at what she does—not just riding the crest of the wave because she happens to be female."

Audrey shrugged. "Reverse discrimination . . . I can see that."

"Whether male or female, you're our resident expert on computers. . . . Have you had any inspirations as to how to get us out of here? I imagine that we'll both be missed at work, but I doubt that it will occur to anyone that we're both trapped in my tunnel. It's not exactly something that happens every day, you know."

"I wish I could say that I had arranged this on purpose so that I could spend the night with you, but unfortunately, we really do have a problem."

"Yeah, like we're almost out of food."

"That's one disadvantage to not being on Earth—we can't just open the window and crawl out."

I shook my head. "Last night I thought about trying to crawl through the air vents, but they're way too small. The only way in and out, at least in this tunnel, is the portal."

"I guess that means that I need to try to work magic on your computer again."

After a little over an hour, she backed out of the computer and sighed. "This is frustrating. The portal works, but we can't get to it because the computer was

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the only way to make it open other than the manual emergency release. To cap it all off, we don't have any software to run the computer even if I can get it fixed."

"The Living Home program won't work?"

"*Ugh* . . . this gets technical. When I put a new interpreter/translator chip in, it goes through a setup procedure of its own. It puts out feelers and learns where everything is, then it assigns new addresses to everything. It sounds dumb, but it's that way because it's a generic chip that can be used in a lot of different computer designs and it needs to be flexible. Of course, I don't even *have* a spare one with me."

"And somehow that means that the Living Home program won't know where anything is, I take it."

She nodded. "Unfortunately, yes, that's exactly what it means. The Living Home program, and others of its sort, bypass the addressing routines in the chip. They depend on being able to use one of a few sets of standardized addresses. I'm sure that at one point the installation program asked you what kind of a computer you had."

I nodded. "Right. I knew the manufacturer, but not the model number. It took me ages to get that figured out."

"I thought so. When you tell the installation program which computer you're using, it copies a table of addresses from the diskette into a PROM chip. Then you're set—usually. There are ways to teach a new chip the standardized addresses, but they require other programs and an instrument that I don't have with me." She shrugged. "I can't carry *everything*."

I leaned over and kissed her on the forehead. "I don't expect miracles. Personally, I'm in awe of you for knowing how all this works."

She smiled. "Thanks. Incidentally, your original program would still work because, being comparatively dumb, it depends on the addressing routines in the chip and by definition the chip will end up knowing where everything is by the time it finishes its setup routine."

"And since, like an idiot, I didn't take a backup of the original operating system, we're stuck. I have learned my lesson, but I'm afraid that it's too late to do us any good."

Audrey sighed in a heartfelt way. "John, I like you—a lot—but I'm not sure you've got the sense God gave a toothpick."

I took this with as much dignity as I could bring to bear on the matter; after all, she was right. I had managed to make a perfect botch of the situation right from the start. I should have listened to Kenny when he hinted that it was not prudent to be getting something that was *almost* what I wanted.

A vague thought occurred to me. "It seems like there ought to be some way to ask the computer to find the portal on its own."

A strange look crossed her face. "I'm a fair programmer."

I raised an eyebrow. "Are you just patting yourself on the back, or are you saying that you can do something?"

She gave me a stern look. "One more comment like that, Mister Brinkman, and I'll have you keelhauled."

"Let me in on the secret."

"Simple, at least in principle. I can write a routine that sends the open com-

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mand to *all* the addresses. Kind of a shotgun approach, but it should work."

"But won't that . . ."

She nodded. "Oh, yes indeedy. You'll think your entire tunnel is having a seizure. *Everything* will do *something*, all at the same time—or at least as far as our senses are concerned it will be simultaneous."

"Kind of like when I would tell the stereo to play and the bathtub would start to fill."

"But more so, because it will be everything at once."

"Will it be dangerous? I mean, will the microwave explode or anything?"

She started to laugh, then switched to looking thoughtful. "I don't think so. At any rate we'll be by the portal so the only thing that I can see that we might have to worry about is that the portal might decide to close before we're through it."

"That sounds grisly."

She shrugged. "We'll just move quickly."

I pushed myself off of the floor. "Well, I'm at your disposal, although I can't see that I will be of much help."

"It shouldn't be that hard. I think I can get it done in less than an hour. If the idea works at all, we will be out of here by lunch."

Watching her stand at the console of my computer was like watching a master conductor leading an orchestra. I wished I had a chair to offer her, but had to be content with promising myself that the first thing I would buy after we got out of the tunnel was a complete dinette set. I didn't even have a box for her to sit on.

She was as good as her word. Within forty minutes she had coaxed my computer into admitting that it had the capability to compile her program —something that I had not known that it was capable of at all—and written the necessary lines. I peeked over her shoulder at what she was entering, but couldn't make hide nor hair of it. I had no referent, but the program looked awfully short to do what sounded like magic to me. Then again, she told me that the language she was using was exceedingly powerful. I hoped so—hexaddress + +; didn't mean a thing to me.

She ran the program through once and sent the results to a file where she could check them manually. Then she fiddled with the program a bit more and rechecked it. Satisfied, she entered the command to run the program and stood with her finger poised over the enter key.

"Ready?"

"Sure. At the very least, we need to go to the grocery store, even if we don't care about going to work and other such sundry nuisances."

She chuckled. "John, you're a nut."

"Perhaps so, but not an edible one."

I wasn't prepared for what happened when she poked the enter key—she had said that the tunnel would convulse, but somehow the warning didn't convey the complete meaning to me. I think I would have been OK had the stereo not come on full blast. The combination of sudden darkness with the throbbing cacophony of a sense-music station completely took me by surprise.

But it worked. The portal opened.

A week later, Audrey and I were

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strolling towards the atrium, arm in arm. Partially in reaction to the food debacle, we had gone out to dinner every night after being released from captivity.

A sudden thought occurred to me. "Hey, there's someone I want you to meet."

She blinked at me. "Really? Who?"

"Just around the corner here." I led her out of the corridor into the vast open space of the atrium and turned right. It was just a few steps to Kenny's concession stand.

He was taking money from a customer happily munching on a hotdog. He glanced up quickly as he was making change, then did a double take. "Hello, Audrey! And Mister Brinkman! I didn't know that you two knew each other."

Caught off guard, I stared back and forth between the two of them. "You two know each other?"

Kenny smiled his knowing smile. "Why, of course, Mister Brinkman. I know all the lonely people. Although it would seem that you two aren't lonely any more. I hope that doesn't mean that you are going to quit coming to see me."

I had hoped to introduce the two of them, but now saw that the joke was on me. Oh, well. "*Never!* You're one of the saving graces of this place, Kenny."

He nodded graciously. "Thank you, sir. And now. What can I get for the two of you this evening?"

After we had ordered, we stood and chatted, telling Kenny how we had met. He grinned and chuckled as he filled customers' orders, talking over his shoulder to us the whole time.

"So what about the emergency latch on your portal?"

"Oh, that. I called the contractor after we got out and made such a fuss that he had it fixed in an hour."

"Are you going to sue?"

"I talked to a lawyer, but it seems that it would be more hassle than it's worth. I just made certain that the news story about our little adventure specified his name, rather than citing an anonymous contractor as being at fault. I figure that was enough punishment."

Kenny had a good laugh over that one. "And what about your job? Weren't they angry?"

"Not after I told them what had happened. We're both minor heroes at our offices for having endured such an arduous experience with dignity and aplomb."

He rolled his eyes. "What's this dignity and aplomb stuff? Are you trying to put on airs?"

Audrey patted the back of my hand. "Never mind him, Kenny. He just needs a keeper. I'll have him whipped into shape in no time."

Grinning maliciously, he said, "Well, it's about time someone took over! I was getting tired of being the only one keeping an eye on him."

We said good-bye and walked once around each of the levels, much as I had done nearly two weeks before. The colors were still as garish, but somehow I didn't mind as much. I was careful to keep a neutral expression as we passed the Living Home display. The lawyer had been more than willing to look into the possibility of at least getting damages from them—enough to cover Audrey's bill and then some. I had already turned in the program and

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the stupid chips for a full refund. Ron was nowhere in sight as we passed.

For whatever reason, the Living Home display was quiet as we walked by. Perhaps the program had at least the wit to be tactfully silent at appropriate moments, even if it wasn't conscious.

When Audrey and I reached the fifth level, we leaned over the edge of the balcony and looked out the dome, now only a few meters over our heads. From this distance it was easy to see the streaks on the underside, but that did not detract from the beauty of the Lunar sunrise outside.

After getting my fill of the austere grandeur, I leaned over and kissed her on the cheek. "I'm glad you're here."

She continued to look out for a few seconds longer, then turned and looked at me. "I'm glad too." She gently brushed my hair out of my eyes. "Do you mind if I get aggressive?"

"Is it proper aggression if you stop and ask the man first?"

She giggled. "No, I guess not."

"What's on your mind?"

"Can I move in with you?"

Now, I don't mind admitting that this took my breath away. I'd hate to think that I have grown so soft that I couldn't take such a statement in stride, but I suppose that it's possible that the years of societal programming were still with me. The only real problem was that I felt like an idiot for not asking her first. I had the funny feeling that there would be no second chance—if I didn't say yes now, I was lost. On the other hand, it went against all my instincts to have the woman take the lead. Damn.

"From the look on your face, I shouldn't have asked."

Uh oh, time to master my ego. I'd hate myself if she slipped away. "Um, actually, I'm just trying to figure out how to say yes."

"Would it help if I threw in a dowry?"

"Audrey, my dear, you're full of surprises. What in the world makes you think you need a dowry to tempt me?"

She leaned a little further over the parapet and pointed to the Dandy Business Center, coincidentally directly beneath us. "After all your recent traumatic experiences, I thought that you might still be interested in owning a consciousness program for your tunnel."

I made a cross with my fingers and held it towards her as though to ward her off. "*Back! Back, foul creature!* I've learned my lesson on that one. Never again."

She laughed and her face lit with that magical, radiant smile. "You silly man. Just because the Living Home was a disaster, you think that all consciousness programs are as bad. What you should have done was take a look at the real thing."

"Do not tempt me, for I am weak. . . . Audrey, those things are expensive. You don't have to buy anything like that just so you can move in. There are a lot of better ways that you can spend your money—invest it, buy stocks, all kinds of things."

"No, no, no, John. Listen to me. I already *have* the program. The real thing—I got it cheap through connections at work. It's in the computer at my tunnel. All I have to do is bring it with me when I move in."

It took a second to formulate a re-

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sponse. "Have I told you that I love you?"

Success! I had caught her off guard.

"I . . . damn you, John Brinkman, you've made me cry! I love you too, you big idiot!"

"Audrey, will you come live with me?"

"I thought you'd never ask."

"Just say yes or no, please."

"Yes, John."

I mopped my forehead. "*Whew*, now maybe my heart will quit hammering. Let's go home."

As we walked back towards the tunnel, I counted my blessings. Life looked very good, indeed. All I had wanted was a program to liven up my tunnel, but the real treasure had turned out to be Audrey herself. To get both . . . I'd call that a bargain at any price. ■

IN TIMES TO COME

● Our June cover, by Nicholas Jainschigg, heralds the conclusion of Harry Turtledove's serial *The Great Unknown.* Catapulted from her comfortable literary professorship by, shall we say, overzealous students, Jennifer Logan has found herself very far from home and in a very large mess that is anything but academic. But, as we've all heard from professors of Greek and Latin, even the mustiest old disciplines can have modern uses. . . .

We'll also have two notable stories from well-known British writers. One is John Brunner's first appearance here in too long, wherein an invention proves considerably (and a bit embarrassingly) more revolutionary than its inventor intended. The other is Paul Ash's novella "Man Opening a Door," dealing with an aspect of parapsychology often neglected: assuming some people have an ability which is sometimes very useful, but also poorly understood, unreliable, and widely feared—how do you train them to use it?

Finally, Richard P. Terra offers "Islands in the Sky," a speculative fact article about the prospects for human colonization of the farthest reaches of the Solar System: the Oort Cloud.

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The Alternate View

QUALITY

G. Harry Stine

The English language is an amazing phenomenon. As a verbalized means of speaking what we think, it also structures how we think. Anyone who has studied another language realizes that those who speak the other language somehow think differently. Reflect on the fact that at this moment, if you were raised with English as your "milk tongue," your thoughts are in English! This, for no other reason, is why it should be important in this modern world to learn to read, write, and speak another language. It drives home the point that everyone in the world doesn't think the way we do. A prime example of this is a direct translation of a German sentence where one says, "Look the window out and see the automobile go the street down."

English, like German, is also a "rubber" language. Not only do we make up new words to describe new things—often not as strangely as they do in German where they usually hang a series of words together to make a new one—but the meanings of words keep changing.

Take, for example, the word "quality." It is used differently to refer to a class, kind, or grade of a product; to describe a distinctive trait, power, capacity, or virtue; in acoustics; in logic; and in philosophy.

It is the first meaning that this column will address.

Every vendor in the world today sells "quality" products. Just ask them. This is true even if the product is really a "second" or one that just barely qualifies as a salable item.

Automakers in the United States are locked into a verbal battle with the Japanese for customers' minds and purchasing power. "Quality" is a current buzz word in all sorts of product lines ranging from appliances to zoom lenses. Places such as Hong Kong, Taiwan, or Singapore that once were known for cheap or shoddy goods are now turning out "quality goods" ranging from custom tailoring to high-tech weapons systems. Some of them really are quality goods. Some aren't. But place of manufacture is no longer the single criterion for selecting a quality product.

Statisticians and quality control engineers have developed means of measuring quality in terms of "failure rate" or "MTBF" (Mean Time Before Failure). A mass-produced device can have an extremely low failure rate and/or a very high MTBF.

But these can be meaningless, just as quality control itself can be misleading when applied to products that were scraped off the bottom of the barrel, rushed into production without adequate field or "beta" testing, poorly designed in the first place, assembled from less-than-adequate parts or materials, or cheapened from the prototype in order to meet price competition.

Some people will contend that a failure rate of 0.00001 is good enough. Or

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that a MTBF of 15 years is outstanding for a product that's designed (warranteed) to last for an average of 5 years. One hears a lot of failure rates and MTBF claims proclaimed.

However, a 0.00001 failure rate or a 15-year MTBF are totally meaningless when the product fails.

Insofar as the user is concerned, the failure rate instantly becomes 1.0000 and the MTBF becomes 0 microseconds when the gadget quits.

We expect our computers, automobiles, and other high- and low-tech devices to work perfectly every time we use them. We count on them. If my computer goes down for whatever reason, I'm literally out of business. Same with the electrical power. I can get along for a while without a telephone or FAX machine, or even the copying machine. Some failures are just nuisances. If a floppy disk suddenly develops an error, whatever I've got stored on it can become nothing more than a series of binary signals, and I've got to reconstruct the file from my own wetware. If my car stops or fails to start, it can be either traumatic or vexing but rarely injurious or lethal unless some critical part like a tire or an axle fails. If my airplane stops while in the air, I'm in very deep yogurt; this is so important that I spend a lot of time making absolutely, positively certain that everything is working perfectly before I commit to flight.

(The manager of a major NASA center once remarked that they were working very hard to get the reliability of the space shuttle to 95%; I reminded him, not so gently, that he wouldn't set foot aboard any commercial transport aircraft and would immediately trade his car if either one had that sort of reliability.)

(Which leads me to yet another aside: Why it is when the space shuttle succeeds, scientists get the credit while, when it fails, it's reported that engineers are working to solve the problems?)

It should be clear at this point that "quality" isn't merely an attribute that relates to product performance. When something quits—as it most decidedly and certainly will; count on it—it must do so in a nonlethal mode. Furthermore, it must be easy to repair rapidly when it does fail. And it needs to have a well-designed and carefully thought out schedule of maintenance—things that should be checked and/or replaced regularly or changed when the useful lifetime nears its end. Then the user must either perform or have the maintenance performed with religious regularity and scrupulous attention to detail.

This requires that many things be done or taken care of. These may be beyond the control of the buyer or user. But not always.

In the previous column, we spoke of the KISS of Death. KISS is an acronym for "Keep It Simple, Stupid!" Often the best designs or products are the simplest. Good engineers are very reluctant to embrace new and untried technologies or ways of doing things; they prefer things they know are going to work. This is one reason why engineers are so very conservative. The bridge must not fall down and the wing must not come off the airplane. So if you are a product manager or a marketing person and you ask the engineers to give you the best job they can, it will always turn out to

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be a very conservative one with a lot of low or old technology in it. The engineers will not stretch the envelope; it might rip or tear. However, if people who are in love with technology or are driven by competitive market forces are the ones who run a company, they are likely to tell the engineers to meet some specifications that are possible because of new technology. The design you get, sell, or buy depends on which approach was used.

But that isn't all.

If a manufacturer is going to provide a real quality product, the company must provide its customers and users with clear and simple instructions on how to use, maintain, and repair the product. I've written about this in these pages before. Most computer hardware and software documentation leaves a great deal to be desired; it's getting better, but some jellyware still has problems with it.

The company must also make the maintenance as easy as possible. I recall one automobile in the 1970s that was a maintenance nightmare; the entire engine had to be lifted off its mounts in order to get to and change the spark plugs. Certain makes and models of aircraft are widely known by the aircraft mechanic community to be difficult to maintain because it's impossible to get to certain critical systems or components without taking the machine apart.

When a part fails, a replacement must be available quickly. This is especially true of commercial aircraft, for example, because the only way to make money with a Boeing 747-400 costing $150 million (batteries included, no assembly required) is to keep it in the air carrying cargo and passengers from Point A to Point B and back again. (Note that cargo is mentioned first; the Boeing 747 was designed to make money just carrying cargo on its lower deck; the passengers are pure profit.) Incidentally, this is only one reason why NASA couldn't even give away the space shuttle to potential commercial operators; the shuttle doesn't spend enough time flying to allow flight costs to be reduced to levels that will attract customers. Any company that makes an FAA-certificated part for a commercial airline has a special procedure to quickly handle a telephone or FAX order that comes in bearing the acronym AOG (Aircraft On Ground).

And the manufacturer must design the product in such a way that no special tools are needed to maintain or repair it. If this isn't possible, any special tools required must be supplied with the product itself at the time of sale. This can lead to a tool monopoly—only the manufacturer makes and sells the tools. Ford Motor Car Company was once in this position because mechanics simply could not fix a Ford without the special Ford tools available only from Ford. IBM was also once this way until it opened the doors to its product architecture and allowed others to write software for the original PC. Ford, IBM, and others learned they could sell a lot more product if they didn't monopolize the tools needed.

Once a product does indeed fail, another aspect of product quality comes to light: you've got to be able to get the busted or inoperable gadget repaired or replaced easily, quickly, and at a reasonable cost. Again, this was addressed

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in an earlier column entitled, "Getting Something Fixed." Some modern "quality-oriented" companies can turn this into a real can of worms. "What did you do? These things *never* fail on their own! You must have done something wrong!" Their "quality" is so "high" that they make it very difficult for a user to get warranty repairs done. They don't announce recalls, or they make it tough to get the recall work done. In short, they do everything they can to hide the defects in their "quality" products. Some companies are notorious for this, and some of them spend a lot of money projecting an advertising image of quality. I suspect you've got your own little list of these outfits. I do.

Any company who does any or all of the things discussed herein and does them conscientiously and well doesn't really have to worry about obsolescence. The reputation of their goods or services will usually sell themselves. I know several mechanics, plumbers, electricians, doctors, dentists, lawyers, and other professionals who wouldn't think of advertising; they don't have to because they've got all the work they can handle and still maintain their own standards of quality that brought the business into their shops in the first place. I buy certain products because I know from past experience that I can count on real quality.

What bothers me—and I hope it bothers you, too—is that our flexible language associates the word "quality" with inferior products. We can do something about it. As manufacturers or producers, we can make real quality goods available. As users, we can insist upon them and raise a little hell about those that aren't. ■

●If God had not rested on Sunday, he could have completed the world.

Gabriel García Marquez

●Youth is a time when the conventions are rightly misunderstood; they are either blindly obeyed, or blindly challenged.

Paul Valery

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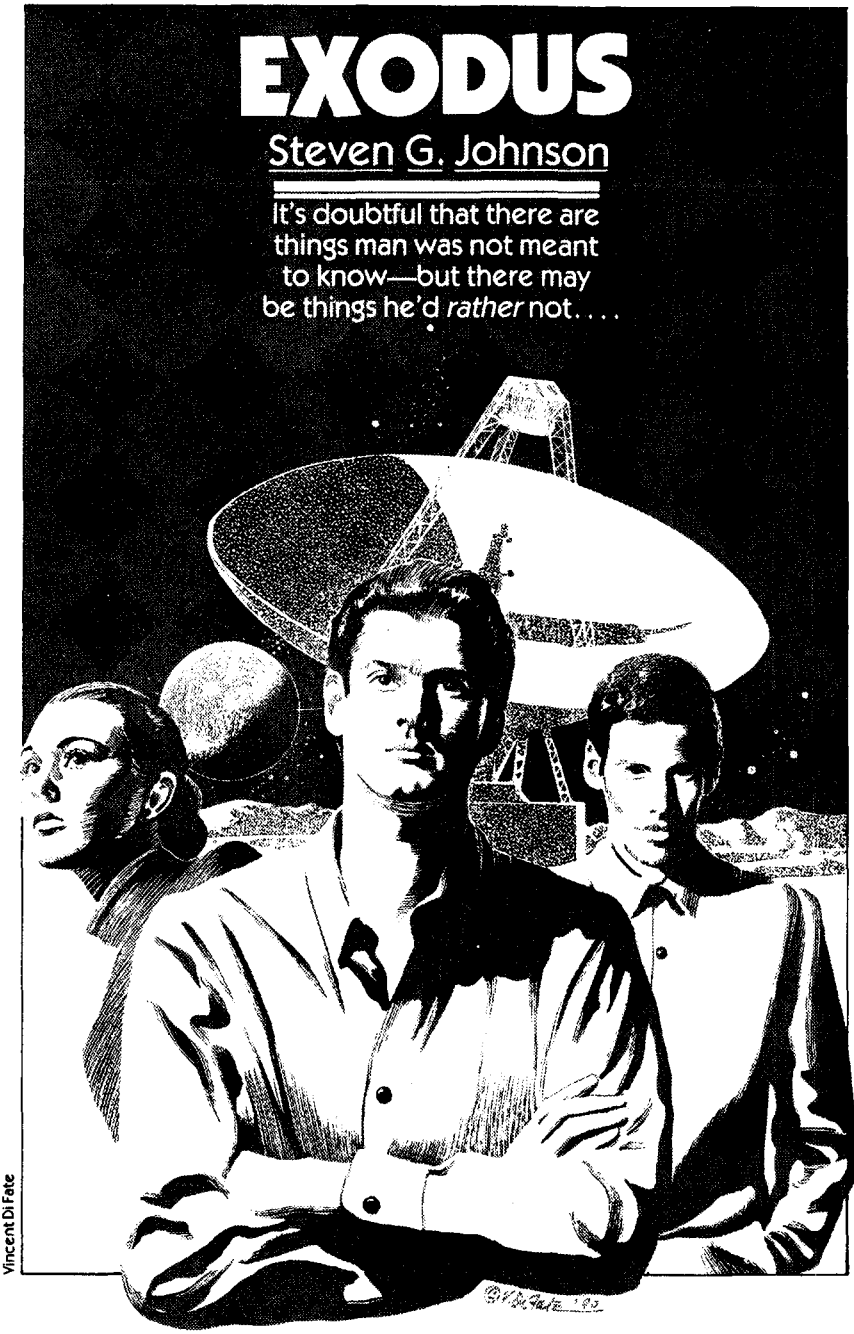
EXODUS
Steven G. Johnson
It's doubtful that there are things man was not meant to know—but there may be things he'd *rather* not. . . .
Vincent Di Fate

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I wish the lunar telescope had failed. Then we wouldn't know.

Why not? The ones before it did, ours and the Soviets's. I came aboard for NASA's third and last try, the one that finally worked.

I won't claim any causal connection between these facts. Lots of other people worked on Lurad 3, too.

Once the dish arrays were up and running, we found out what had bollixed up the previous telescopes: lunar magnetism. The Moon hasn't got a magnetic field of its own, of course, but some of the surface rocks are magnetized just a little bit; enough to throw off one hundred radar dishes spread over one thousand miles of the airless landscape. The dishes are the "telescope"; by combining the data from each one and interpolating the gaps, we get a composite picture as clear as if we had one thousand-mile-wide dish, without actually having to build one.

Once we found all the magnetic anomalies—"magnoms" in Lunar talk — and corrected for them, we had the best look at the Universe that Man has ever managed.

Funny how long it took to notice the quasar. But then, it had been there since before there were human beings at all. What's a few more weeks?

Harinder Singh Garcha noticed it first, three weeks after we started up in earnest.

"Didn't your mother ever teach you to put your toys away where you found them, Stan?" were the first words he said that day. He'd just relieved me at the big imager, and he was smiling when he said it.

"Naw, she always said if I put 'em back where I got 'em, the store clerk might see me. What's eating you, Raja?" I said, smiling back.

"This imager. You've got QSR-2122 overlapping Magellan's Cloud, that's what! Am I supposed to reset it for you?"

Resetting the imager was a two-hour job, involving a trip to the cryonic memory room and tedious keyboarding. I didn't blame him for being irked.

"I didn't do it, copper. You got nothin' on me, see?" I said, but I came over to the console anyway.

"If it's a glitch in the system, we ought to know so we can fix it," Raja said. He didn't believe I was at fault either.

"Yeah," I said, visions of dinner and sleep long gone. "I'll stick around 'till we do."

QSR-2122 was a quasar, a "quasi-stellar radio object." Like many astronomical terms, it was a bit dated. Nobody thought there was anything even remotely starlike about quasars any more, not since redshift calculations showed the nearest one to be billions of light-years away. Anything we can see over that distance is *definitely* too bright to be a star.

Or so we thought.

Sure enough, the image of QSR-2122 was beginning to overlap several stars in the Greater Magellanic Cloud, the nearest galaxy to our own. I looked for other signs of distortion, saw none, and punched up the self-test routine for the imager.

Nothing. The imager was completely balanced.

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A quasar ten billion light-years away cannot possibly get between Earth and a galaxy only 100,000 light-years away. Therefore, without question, the imager's diagnostics must have been faulty. We tore it apart.

We spent three days going over every subassembly and connection in that incredibly complex piece of equipment, testing the checking and testing again. Raja had his wife visit and bring sandwiches; being single, I arranged for my cat to be fed, and promptly forgot the outside world.

After two days with no hint of an answer, our supervisor called for some newspaper prints for Earthside. We told her to come down and see why we couldn't do it.

Tu Vinh stood in the doorway with her mouth slightly open, framed by parts of the imager bobbing in dust-proof baggies. She squinted through a web of colored wires, trying to make us out.

"Mr. Jackson? Mr. Garcha?" she called. Raja's head poked out of the tangle.

"Yes, Ms. Vinh. We're both here; but as you can see, the imager is not. At least, not yet."

She took a half-step into the room.

"What has happened to it?" she asked.

"We don't rightly know yet, ma'am," came my voice from beneath a disk-pack carrier. "We got some funny readings in the Magellanics, so we're trying to track down the fault. I hope it's not software, but it's beginning to look like it can't be anything else."

"Very well. I will use the smaller imagers. When can you have this one on-line again?"

"Should be tomorrow or the next day, Ms. Vinh Tho," said Raja.

She thanked him and left. Half an hour later, she was back.

"Mr. Jackson? What problems did you have with the imager?" she said without preamble.

"Uh, we had a quasar overlapping some stars in the Greater Cloud. Still no luck on a solution," I said.

"I obtained the same results on the smaller imagers. Both here and in Calibration."

"What?" yelled Raja.

I said, "So we're all doing something wrong. Maybe the image interpretation function—" Tu Vinh cut me off.

"I would be grateful if you gentlemen would join me in the lounge. Can you leave this as it is?"

"Uh, yeah. Come on, Raja," I said, but he was already at the door.

We sat on overstuffed chairs in the lounge of Imaging Section. The Lurad 3 logo blazed from all four walls and Tu Vinh's clipboard. She had a Lurad 3 lapel pin on.

"Gentlemen," she said softly, "what does this mean?"

She handed us a stack of negative prints, white space with black stars, which most astronomers prefer. They were dated today.

Half were from Imager One, half from Two. There were none from our imager, of course, but each of the smaller models had integrated enough dish data to produce a composite sharper than the human eye could dream of seeing.

They looked exactly like the big im-

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ager's screen had. QSR-2122 was occluding a galaxy.

"Three possibilities," I said, after a pause. "An unsuspected fault in the imaging software; an overlooked magnom, despite all our checks; or—"

"QSR-2122 is between us and the Cloud," Raja said. "But that's impossible."

"Why is it impossible?" asked Tu Vinh, pointing at the pictures. "There it is."

"Because of the redshift," I said. Raja sighed.

"Redshift is a measure of an object's velocity relative to an observer. When a plane flies overhead, its pitch grows higher, then lower as it passes you, right?" She nodded.

"Well, the plane's engine noise doesn't change. What happens is the sound waves coming from the approaching plane reach you closer together than when it's at rest; thus, the wavelength seems shorter, and the sound seems higher.

"Same deal with light waves. If an object is receding at a good fraction of the speed of light, it seems redder because the light waves are longer."

"The faster an object is moving, the redder its light will appear. You *know* all this," I said.

"I wish to clarify my thinking. Pray continue."

"OK. In the 1950s, Hubble noticed that some stars are redshifted more than others. Distant galaxies are redshifted dramatically.

"In fact, the further away *any* object is from us, the greater its redshift, and thus, the faster it appears to be moving from Earth.

"Every object in the visible Universe follows this relation. What this means is that as the Universe expands, every point is rushing away from every other point; therefore, it appears as though the Universe is hurtling away from us.

"When quasars were discovered to have a redshift corresponding to 95 percent of the speed of light, they were assumed to be far away indeed; billions of light-years, in fact, by the Hubble relation. They're the most distant objects in the heavens," I said.

Raja picked it up; quasars were one of his specialties. "The question of how quasars can shine so brightly at such a colossal distance has puzzled scientists for decades, Miss Vinh. No known energy source can explain it."

We could. At least one quasar was closer than the nearest galaxy.

Raja put his hand computer through its paces. He frowned at us.

"Assuming a maximum distance of 100,000 light-years, that quasar has a brightness appreciably less than a white dwarf star. It's a very concentrated point-source, possibly a tiny supernova," he said.

"How do you know?" asked Tu Vinh.

"Its coloration, corrected for redshift, indicates a surface temperature that boggles the mind. If it were anywhere near as big as the Sun, its total brilliance would be much greater than we see. Ergo, it is quite small."

"And the redshift? How is that caused?" She was taking notes.

"There are only two ways to stretch light waves, Miss Vinh: gravity and velocity. The quasar's light is either passing through a phenomenal gravity

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well, or the quasar is moving at nearly the speed of light."

"Away from us?"

"Yes, of course," Raja answered as if it were elementary. Well, I suppose it was.

"And the other quasars? Are they also closer than we suspected?"

We looked at each other.

"I don't know," I said. "It's always been assumed . . ."

"That is what we are here for, to find that our previous theories are not exact. I will ask Dr. Kidd in Observation to conduct a survey of the known quasars, and any new ones that Lurad may have discovered. Can you gentlemen interpret his results?" she asked breathlessly. Tu Vinh was pretty brusque, but it was clear that the excitement of discovery moved her as much as it motivated us.

"You bet we can!"

The survey results poured in at once from Data Storage; seems quasars were high on everyone's list of things to ponder. The Soviets were known to have coveted the mysterious power quasars used to shine across the deeps; now that they were a lot closer, the magic power source looked a lot less promising.

Their color raised more questions than it answered. Mossberg in Spectroscopy ran the color plates five times; every time the answer was the same.

"That's a fusion flame," I said.

"Yeah?"

"The frequencies we're seeing are what you'd expect from hydrogen-hydrogren fusion redshifted at 99 percent the speed of light. We're seeing almost no helium or other elements in the mix. What does that say to you?"

Raja frowned again. "A protostar?"

"Could be. Protostars haven't had time to burn much of their hydrogen into helium, so they're almost pure hydrogen. But a protostar moving at nearly lightspeed? Not very likely," I said.

"Got a better idea?" said Raja.

"A Bussard ramjet," I said. "Sweep a magnetic field a few hundred thousand kilometers ahead of your ship and attract all the interstellar hydrogen into your engine. Space isn't quite empty, you know; you can get an atom of hydrogen per cubic meter or so, absolutely free."

"Then . . . you think these quasars are spaceships?"

"Sure, why not? Some of 'em, anyway. The ones we saw occluding various stars for sure. The others . . . I don't know. Occam's Razor says they're all the same thing, unless we have reason to think otherwise."

"Hmm . . . I don't know if we do or not," Raja said. "But I was down in Calibration this morning, and they worked up a little chart for me. What can you make of this?"

He spread a large chart on my desk. Working on Raja's approximate value for quasar brilliance, Prosinski's boys had determined that all visible quasars were confined to a radius of 90,000 LY of Sol, plus or minus 20,000 LY. None were closer than 50,000 LY, same error.

Most of the graph was composed of short bars rather than points. Each quasar showed a slight variance in redshift, which supported my spaceship theory. Hurtling stars don't maneuver.

Several of the little bars were circled in red. These were projected locations;

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Prosinski and Kidd had compared notes and discovered that several quasars had gone out in the six months that Lurad 3 had been operating. They had suddenly expanded, dimmed, and vanished.

I pointed at the big chart.

"But, Raja . . . that means they're fleeing *our* Galaxy. Ours in particular."

"It does, doesn't it? Hmm . . ."

I kept right on going. "You'd think if the galaxy were too crowded, they'd have shown up here by now. I guess they decided not to settle Earth, for whatever reason."

"Unless every galaxy throws off showers of quasars now and then; we could be going through such an epoch now," he added. Raja didn't like spaceships.

"Why don't we see any other galaxies with quasar halos, then?"

"Maybe they're *really* rare. Maybe we're unique," he said weakly.

"Uh-huh," I said. "We can see a hundred million galaxies and only ours has quasars. Do you believe that?"

"OK, maybe they're spaceships. Let's try that assumption and see where it leads us."

I rubbed my hands together.

"OK. First: why are they going out?"

"Reached their destination?" Raja offered.

"In intergalactic space? Come on, man! What's out there that they'd want? It's as empty as empty can be!" I was shouting.

"Hey, Stan, take a deep breath. We don't have to decide right now what they're up to," he said. "You want some coffee?"

"Yeah—no, water. Got to keep a clear head," I said. Neither of us was tired. We wouldn't be until the answers stopped flowing.

Raja washed out my mug and filled it.

"Look, maybe intergalactic space isn't hostile to these guys," he said. "Maybe they can live in empty space; a closed recycling system for life support, and bring all the metals with you. You could do it."

"But there's plenty of empty space right here in this Galaxy. Why go all the way out there? What's wrong with the Milky Way?" I said.

We stared at each other in horror.

There were a lot of quasars. What *was* wrong with the Milky Way that made millions of ships want to leave it at top speed?

And what was happening to those ships?

"Oh my God," I said softly.

"M-maybe we're all wet here, Stan," Raja sputtered. "I mean, sure, they chose to emigrate, but who knows what their reasons were? Plague? Religious reasons? Civil war?"

"Maybe they live on really rare planets, with liquid bromine, or plutonium-based life. Maybe there just aren't planets they can use in this Galaxy, so they're looking for more. And that's why they never bothered with the Earth."

"Why are they going out now?" I said.

Raja would have blushed if he hadn't already been pale.

"Uh, right. I don't know."

"There are only a couple of reasons they could be going out," I said, ticking off my fingers.

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"One: they could be shutting down their drives to conserve fuel, assuming they don't have a ramjet. No way do they carry enough fuel to boost up to lightspeed, let alone come down from it. Even antimatter isn't that efficient, and there just can't be anything more efficient than total conversion."

"And what if there is a, a free energy drive?"

"Then they don't need to conserve fuel at all," I snapped. Raja shut up.

"Two: they stopped. Unless they can stop on a dime, we should have seen their red shift decrease to zero over a period of time. We didn't.

"Three: they blew up. Something or somebody turned their drive off for them, turning them into a cloud of gas that glowed for a little while. . . ."

"Jesus," said Raja. "The flare."

"—before it cooled enough that we couldn't see it at this distance," I went on. "For most of their journey, they could have had a missile on their tail, boosting at a slightly higher rate than theirs."

"Those spikes in the redshift."

"Yeah. Every time they turned to avoid it, the ship's drive would peek out from behind the missile's drive, as seen from Earth. Then the missile would correct . . . and when it finally caught them, both drives went out. Pow," I breathed. My mouth was dry again.

"The guys who launched the missiles—if there are any—were around a hundred thousand years ago."

"At least."

"So where are they now? If they were here, in our Galaxy, shooting all comers with lightspeed missiles: where are they now?"

* * *

Neither of us had anything more to say for ten hours. The day shift was trickling back in when Raja jumped up from his seat.

"Here it is," he said, his flat tone in stark contrast with his twitching, fidgeting posture.

I sat down at the imaging screen. A colored sky chart glowed upon it.

"I brought it up from the IRAS—the infrared sky mapping satellites. Remember them from the eighties?" Raja said tiredly.

"Yeah. What am I looking at here?"

"Well, the green points are all known stars and clusters. I have them turned way down. Then we have these hot dust clouds in red, here, that mask the galactic core and inner spiral arms. Some of 'em are hot 'cause protostars are forming inside 'em; most of 'em just absorb and retransmit light and I-R from the core stars. But we can't see much through 'em."

Raja manipulated his keypad. A series of blue motes sprang up against one of the clouds.

"But some of them aren't." He tapped a pair of dots with a thick forefinger.

"These here," he said, "are right out in the open. They're X-ray point sources invisible to light or I-R. Their absorption spectra have never been measured, until now. What do you think the Doppler factor is?"

X-rays but no visible light . . . "They'd have to be putting out hard gamma rays! You mean *none* of their output is visible?" I exclaimed.

"Stan, Stan . . . you've got it all backwards. Their spectra are normal

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hydrogen-helium lines, shifted into X-rays. They're *blue*-shifted, man. Blue-shifted all to hell."

"They're coming right for us," I breathed.

"At damn near lightspeed," he agreed. "And from *within* the Galaxy. Another twenty, thirty thousand years, they'll be here. And what can we do to stop 'em?"

"Why should we stop them? They've run a long way; whatever they're running from, it hasn't killed them yet. In 20,000 years, we'll have advanced, grown; maybe even surpassed them! We'll lick their bugaboo together!" I shouted.

"Stan, you still don't get it. Every other migration went away from the Galaxy, but these guys are coming through it. Like they own it."

"Stan, these are probably the ones the others were running from."

A long chain of inferences, sure. But plausible. And there's Something out there, coming this way like a bat out of hell. Maybe not enemy aliens, or missiles, but *something*.

Can we afford to take the chance? We have to get off the planet, now, to start an interstellar culture strong enough to oppose them before they get here! Once they do, it'll be too late.

We still haven't convinced anybody in authority. It looked as though we were having some success in the media, but then the fad died, as they always do. Politicians aren't interested in old news; and as for the scientific community, we can't convince the fortunate few who have pull with the military or industry.

But we'll keep trying. We will!

Because Raja and I haven't mentioned the real reason we're afraid. We'd start a panic for sure, maybe wreck the only chance we have.

The lights are 30,000 light-years away. And we can see them today.

But the ships are moving at .999 lightspeed. Which means they'll arrive just behind the light they give off.

Thirty years . . . ■

●The benefits bestowed on us are welcome as long as we believe they can be repaid. Once that time has passed, gratitude is replaced by hate.

Tacitus

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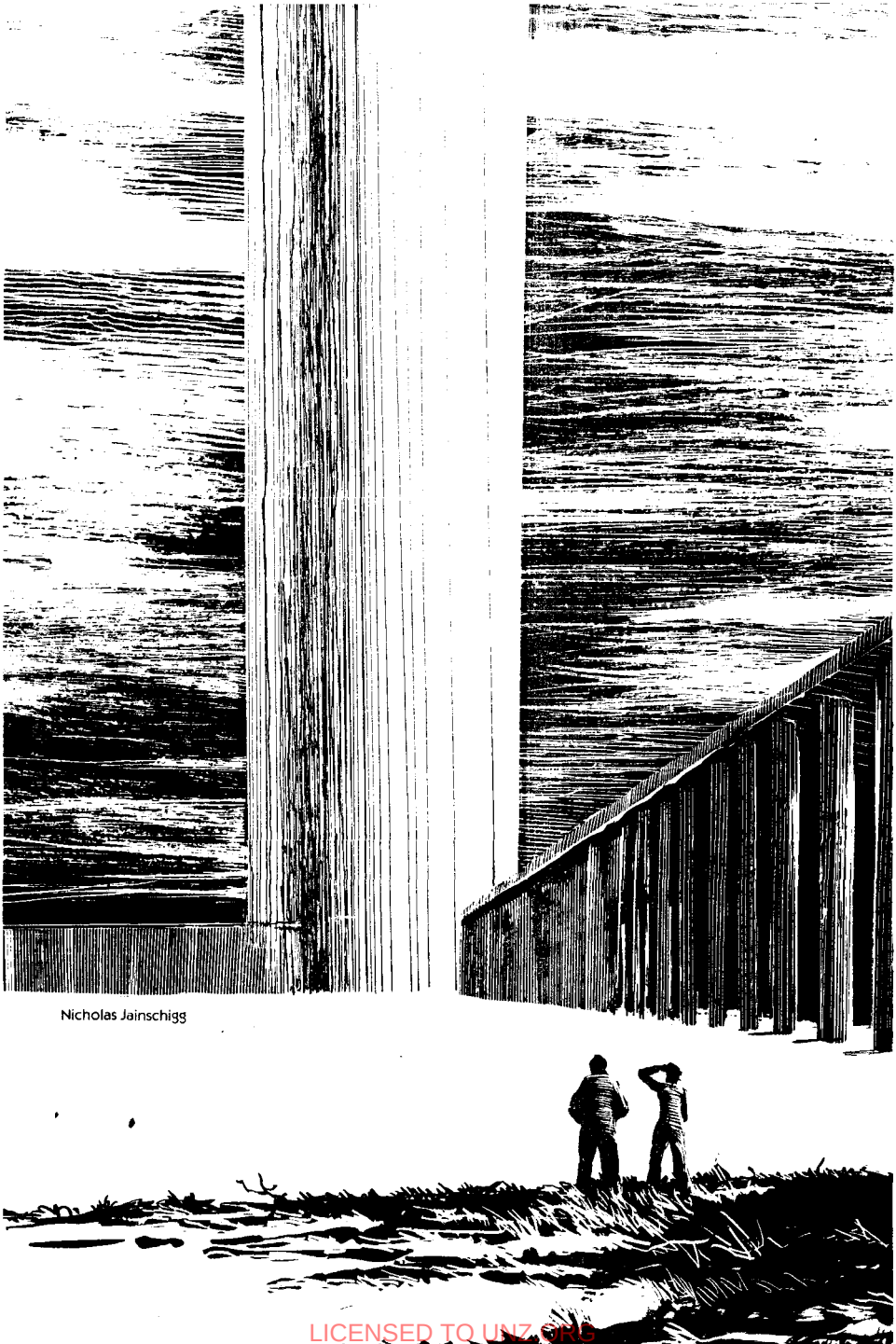

Nicholas Jainschigg

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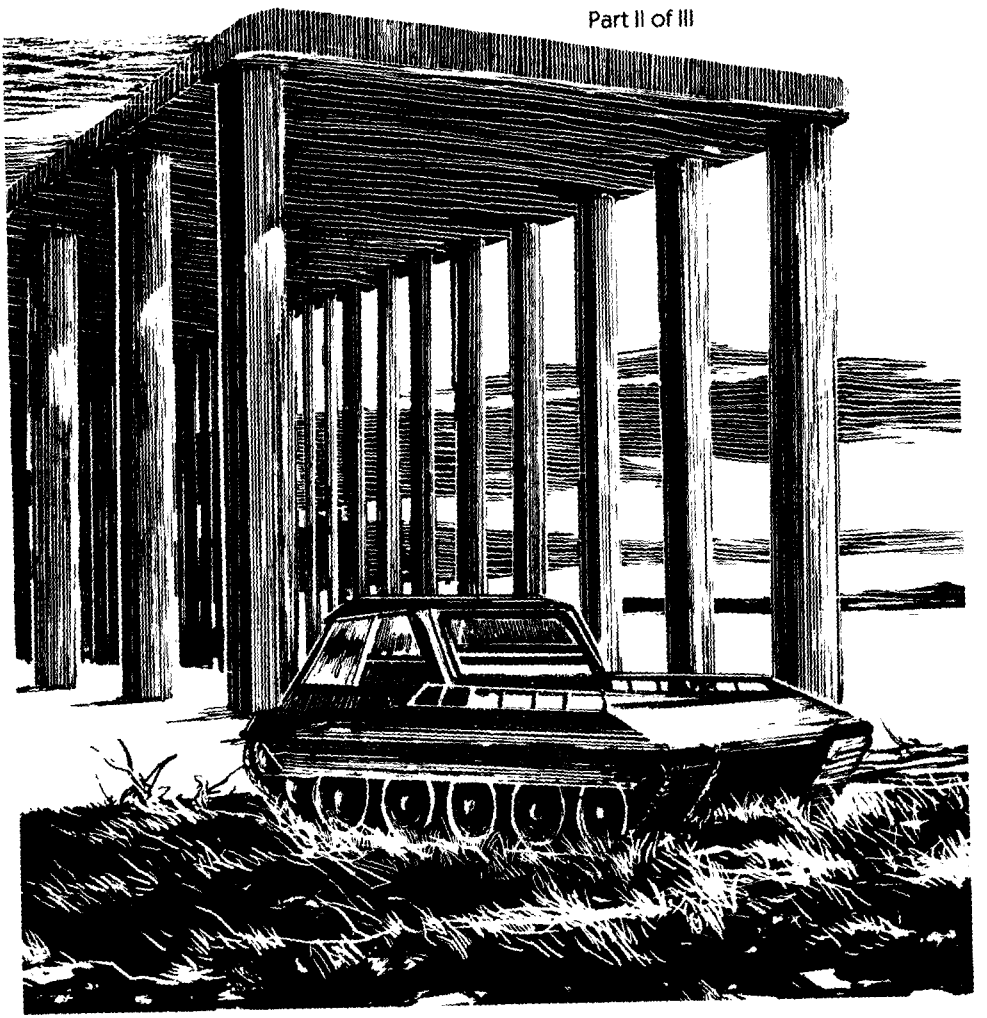
THE GREAT UNKNOWN

Harry Turtledove

There's one very large risk inherent in devoted hero worship . . .

Part II of III



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SUMMARY

After several years as a trader, **Jennifer Logan** *had finally gotten just what she'd always wanted: a post teaching Middle English science fiction at Saugus Central University. When she started her third semester there, though, she got a surprise: she discovered that three* **Foitani** *were enrolled in her course. The Foitani had been a great race once, but 28,000 or so years before had almost exterminated themselves in a series of conflicts they called the* **Suicide Wars**. *Only now were some of the planets where they survived emerging from the barbarism into which the wars had cast them. Jennifer was wild with curiosity as to why the large, blue, rather fierce-looking aliens were interested in ancient literature, but she could not bring herself to ask; the Foitani themselves volunteered nothing.*

When she tried to explain her excitement to her boyfriend, **Ali Bakhtiar,** *she ran into a stone wall—he was more interested in watching battleball on the holovid. His complete indifference sparked a fight that led to her moving out; she arranged to stay with her friend* **Ella Metchnikova** *until she could get an apartment of her own.*

*The Foitani—***Thegun Thegun Nug, Aissur Aissur Rus,** *and* **Dargnil Dargnil Lin***—proved to be good students, whatever their motivation. They still revealed little of themselves, though Dargnil Dargnil Lin showed an almost religious faith in the abilities of the* **Great Ones**: *the Foitani who had lived before the Suicide wars.*

One night just before Jennifer was going to move into her new apartment, Ella had her lover come over. Jennifer decided to spend the evening in her office, which boasted a couch on which she could—she hoped—sleep. Ali Bakhtiar and Ella called her one after the other to let her know the Foitani were looking for her. A little later they found her, and asked, or rather told, her to come with them. When she refused, Thegun Thegun Nug stunned her.

She woke up on a Foitani starship. The food, water, and sanitary setup aboard said ship were minimal—a bit less than minimal, as she was female. Thegun Thegun Nug informed her that she had been hired at journeyman's trader's wages on the recommendation of another human. She could not imagine who had recommended her to the Foitani, or why, but she did not think kind thoughts about that person.

Aissur Aissur Rus explained that the Foitani of his planet, **Odern,** *were interested in regaining the level of civilization the Great Ones had achieved, and she could somehow help in that process. Just how remained obscure until the starship landed on Odern. There she learned who had suggested that the Foitani contact her: her old trading chief,* **Bernard Greenberg.** *She grudgingly forgave him when she realized he hadn't intended that they kidnap her.*

She also learned from a Foitani official named **Pawasar Pawasar Ras** *that his people had found, on a nearly dead world called* **Gilver,** *a monument they called the* **Great Unknown;** *it dated from the time of the Great Ones and infallibly drove Foitani mad. That made them curious and desperate enough*

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to seek help from another race, which was how Greenberg had gotten involved.

Jennifer took up residence aboard his ship, the Harold Meeker. *After a while, she and Greenberg, who had been occasional lovers in the past, resumed their relationship, not least because they were the only two humans within a thousand light-years.*

The Foitani ordered Greenberg and her to accompany them to Gilver in the Harold Meeker *to try to solve the riddle of the Great Unknown. On the way there, a hyperdrive trap from the time of the Great Ones pulled their ship and the Foitani vessel, the* Horzefalus Kwef, *back into normal space, where a missile would have destroyed it but for the Foitani. No human world knew how to make such a trap. It gave Jennifer a good deal to think about.*

A few days later they emerged from hyperdrive near Gilver, only to find it under attack by Foitani from another surviving world, **Rof Golan**—*a different and more predatory race. Being on the paranoid side, the Foitani from Odern had installed a military base there even though they thought Gilver their secret. They drove back the Rof Golani and let the* Harold Meeker *and* Horzefalus Kwef *land safely. Jennifer and Greenberg emerged to join the Foitani scientific team studying the Great Unknown.*

PART II

The planet Gilver had had little to recommend it even before the Foitani from Rof Golani attacked. Back on Earth in what was still the Pleistocene, the Foitani had done a much more thorough job on it during their Suicide Wars. They'd eliminated their own species from the planet, and had come too bloody close to destroying the whole ecosystem. Life still clung to Gilver. It no longer thrived there.

Jennifer found depressing a landscape that showed more slagged desert than forest and grassland. When she looked east rather than west, though, she looked toward a landscape with no life at all: the precinct surrounding the Great Unknown was as sterile as an operating theater. The column at the heart of the Great Unknown speared the sky, though the research facility of the Foitani from Odern was more than fifteen kilometers away. That seemed to be far enough to keep the big blue aliens safe from the hideous insanity that plagued them closer to the gleaming white tower. Their instruments wandered the precinct of the Great Unknown and probed what they could; the Foitani themselves were barred.

"The instruments don't pick up too much, either," Jennifer complained.

Aissur Aissur Rus said, "If instruments provided the data we need, we would not have been required to requisition your services."

She gave the Foitani reluctant credit for not being mealy-mouthed, but said, "If I'm going to do you any good at all" (*and if I'm ever going to get out of here,* she added mentally), "I'll have to examine your Great Unknown for myself."

"By all means," Aissur Aissur Rus said. "The human Bernard is already proficient with our ground vehicles. Before you enter the precinct of the Great Unknown, you would be wise to

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acquire a similar proficiency. Bear in mind that, should difficulty arise, you will have to effect your own rescue, as we shall be unable to come to your aid."

She had to admit that made sense. The ground vehicle proved simple to operate. It was a battery-powered sledge, tracked for good ground-crossing capability, and steered with a tiller. The size of the tiller was her only problem; she had to stand up to shift it from side to side.

She and Greenberg rode separate sledges into the area surrounding the tall white pillar. The Foitani had not argued about that; they believed in redundancy too. The vehicles purred forward side by side. After they'd gone four or five kilometers, Jennifer said, "We have more privacy here than we did on the *Harold Meeker*. Whatever we do, the Foitani aren't going to come after us to stop us."

"True enough," Greenberg said, "but what do you want to bet these chassis have explosives in them along with the motors?"

She thought it over. "You own a nasty, suspicious mind, and I've no doubt whatever that you're right."

They rode on. The sledges had one forward speed, slow, and one reverse speed, slower. Eventually they reached the beginning of one of the colonnaded paths that led inward to the Great Unknown's central column. The path, of gleaming gray stone, was as fresh as if it had been set in place the day before. Not even a speck of dust marred its surface. However the Great Ones had managed that, Jennifer wished her kitchen floor were equipped with a like effect.

The columns which supported the roof overhead gradually grew taller and thicker as they approached the central tower. The effect went from impressive to ponderous to overwhelming. Jennifer did not think that was merely because she was smaller than a Foitan. How any living creature could have felt anything but antlike on that journey was beyond her.

She said, "I don't like this. Why would the old-time Foitani want to make themselves into midgets? I've seen pictures of our own monumental architecture—the pyramids of Egypt, the freeways of Los Angeles—but none of it, not even the pyramids, set out to deliberately minimize observers the way this thing does."

"The stuff you're talking about was done in low-tech days," Greenberg said. "I suppose the effects were worked out empirically too—on the order of, it's big so it must be impressive. The thing to remember about the old-time Foitani is, they knew exactly what they were doing. They had all our modern building techniques and then some, and they were able to figure out just how they wanted this thing to look, too. And if it works on us, just think what it does to their descendants."

Jennifer thought about the tapes she'd seen, then quickly shook her head. She preferred not to recall the drooling, mindless Foitani who had come to the Great Unknown. She tried to imagine instead what the colonnade might have been used for, back in the days of the great Foitani empire. She pictured hundreds of thousands of big blue aliens triumphantly marching toward the column, and hundreds of thousands more

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standing on either side of the path and cheering.

That wasn't so bad. Then, though, her imagination went another step, as the imagination has a habit of doing. She pictured the hundreds of thousands of triumphal Foitani herding along even more hundreds of thousands of dejected, conquered aliens of other races. She pictured those other aliens going into the base of that clean, gleaming kilometer-high column and never coming out again.

She shook her head once more. From everything she knew about the Great Ones, that latter image had a horrifying feel of probability to it. She asked Greenberg, "Is there any way to get inside the column?"

"The Foitani have done magnetic resonance imaging studies that show it's not solid—there are chambers in there," he answered. "None of their machines found an entrance, though, and I didn't either, the last time I was here."

"Might be worthwhile blasting a hole in the side," Jennifer said.

"Might get us killed for desecration, too," he pointed out. "They've been studying this thing for a long time. If they wanted to try blasting their way in, they would have done it by now. Since they haven't, I've operated on the assumption that they don't want to."

"A shaped charge wouldn't do that much damage," Jennifer said, but then she let it go. She feared Greenberg was right. The Great Unknown was the principal monument the imperial Foitani had left behind, at least so far as their descendants on Odern knew. If they'd wanted to break into it by brute force, they probably would have done so for themselves.

Now the column was very close. Greenberg drove right up to it, halted his sledge. Jennifer stopped beside him. She craned her neck and looked up and up and up and up. The experience made for vertigo. Her eyes insisted the horizontal had shifted ninety degrees, that she was about to fall *up* the side of the tower and out into space.

She needed a distinct effort of will to wrench her gaze and look back to Bernard Greenberg. He smiled a little. "I did just the same thing the first time I came here," he said. "The next time I looked at my watch, ten minutes had gotten away from me."

Jennifer found that she wanted to look up the side of the tower again. She ignored the impulse until it sparked a thought. "Do you suppose this is what sets the Foitani off? Maybe it just hits them a lot harder than it does us."

"I don't think it's anything so simple," he answered regretfully. "For one thing, it doesn't begin to explain why they're *drawn* here from ten kilometers away."

"No, it doesn't," she admitted with equal regret. She climbed down from her sledge. "I'm going to look around for a while."

Her shoes scuffed on the polished gray pavement. But for the faint whistle of wind between columns of the colonnade, that was the only sound for kilometers around. If Gilver boasted any flying creatures, they stayed away from the precinct of the Great Unknown. Jennifer found herself missing birdcalls, or even the unmusical yarps of the winged beasts native to Saugus.

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She also found herself deliberately keeping her back to the white tower so that she would not have to look up at it. As deliberately, she turned around to face it. She refused to let the Foitani intimidate her.

She walked over to the tower, kicked it hard enough to hurt. Greenberg gave her a quizzical look, which she ignored. She'd booted the water bottle the Foitani had given her all the way across her chamber. She wished the tower would fly through the air the way the water bottle had. It stubbornly stayed in place.

"As if anything that has to do with the Foitani ever paid the least bit of attention to what I wish," she said, more to herself than to anyone else. With her pique at least blunted, she climbed back onto her sledge, turned it about, and headed back down the colonnade road toward the Foitani base outside the radius of insanity.

"What are you doing?" Greenberg called after her. "You just got here."

"I've seen all I need to see, for now," Jennifer answered: "Enough to make me certain I'm not going to turn the Great Unknown into the Great Known by walking around and peering as if I were Sherlock Holmes."

"That's the second time you've mentioned him to me. Who was he?"

"Never mind. An ancient fictional detective." Not everyone, she reminded herself, read Middle English, or even Middle English authors translated into Spanglish, for fun. She went on, "Anyway, the point is that I need more data than my eyes will give me. If the Foitani here at their base don't have those data, nobody does."

"What if nobody really does?" Greenberg asked. He was coming after her, though. The Great Unknown didn't drive humans crazy, but that didn't mean anyone enjoyed being around it, either, especially by himself.

"If they don't have the data we need, then maybe we ought to think about manufacturing some shaped charges and getting inside to see what's hiding there. If the Foitani want to call that blasphemy or desecration, too bad for them. They can't blame us for not coming up with answers if they won't let us ask the right questions."

"Who says they can't?" Greenberg said. Past that, though, he did not try to change her mind. She wondered if he agreed with her or if he was just waiting for her to find out for herself.

About one thing he'd been right: if the Foitani base on Gilver wasn't the dullest place in the galaxy, that place hadn't been built yet. The base was mostly underground, which had served it well when the attack from Rof Golan came. It only served to concentrate the boredom, though, because the Foitani didn't seem to care much about getting out and wandering around. There Jennifer had trouble blaming them. Gilver had not been a garden spot before the fleet from Rof Golan hit it. It was worse now.

Jennifer decided to beard Aissur Aissur Rus first. Of the Foitani with whom she'd dealt, his mind was most open. When she proposed blasting a hole in the tower, he studied her for a long time without saying anything. At last, he rumbled, "I have been urging this course on my colleagues for some time. Some say they fear the tower has defense facilities incorporated into its con-

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struction and so are afraid to damage it. Others tell me frankly they believe the demolition would be a desecration. I prefer the latter group. Its members are more honest."

"If you won't test, how do you propose to learn?" Jennifer asked.

"Exactly the point I have been trying to make," Aissur Aissur Rus said. "Now that I have your support for it, perhaps I can persuade some of my stodgier fellows to see that it is only plain sense."

"Or maybe they'll oppose you even more because you have a non-Foitan on your side," Jennifer said, thinking aloud.

"Yes, that is certainly a possibility. On the other hand, the Foitani of Rof Golan have also evidenced a strong interest in the Great Unknown. I would sooner be associated with a non-Foitan than with those savage beings who style themselves Foitani. So, I think, would others."

That righteous anger, delivered in the translator's toneless voice, made Aissur Aissur Rus seem more nearly human to Jennifer. Preferring the out-and-out infidel to the heretic, to one's own gone bad, had roots that went back to Earth and were ancient there.

"Let us take this up with Pawasar Pawasar Ras," Aissur Aissur Rus said, apparently fired with enthusiasm. "He always denied my requests when he stayed on Odern. Now that he has at last seen the Great Unknown for himself —and seen that the Rof Golani covet it –perhaps he can be made to feel as certain that we can unravel its mysteries as if he were to find himself just within the radius of doom."

Radius of insanity was Jennifer's term for it, but she had no trouble following Aissur Aissur Rus. She looked up at him. He was staring away from her, staring at an empty spot a meter or so in front of the end of his muzzle. His gaze held enough intensity to make her shiver. She used once more the standard she'd learned as a trader: "May I speak without causing offense through ignorance of your customs?"

Aissur Aissur Rus needed a moment to return to himself. Then he said, "Speak."

"Just—a feeling I had. Were you ever on the fringes of the radius of doom?"

His big, rather ursine head swung quickly toward her. "It is so. How could you have deduced it?"

"You used the comparison you made as if you understood exactly what it entailed."

Getting a Foitani from Odern to show alarm was not easy. Jennifer had seen that. Now she saw one who was alarmed, and did not try to hide it. Aissur Aissur Rus's plushy blue fur rose till he looked even bigger than he was. He bared his teeth in a way different from, and more frightening than, the usual frown-equivalent. His eyes opened so wide that Jennifer saw they really did have a pale rim.

He paced up and down the chamber, working hard to bring himself back under control. At last he turned back toward Jennifer and said, "May I never have such an experience again. I knew the danger, but proved to be unfortunate. Most of us may safely work at a distance within my personal radius of doom. I went to discuss some instru-

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ment readings with a technician, and found myself—"

He paused. His fur stood on end again. He waited until it had subsided before he went on, "I found myself filled with insight such as I'd never had before. I knew—I could feel that I *knew*—exactly how to comprehend the Great Unknown. I started to go toward it, to implement my knowledge. I went by the most direct route. I threw a desk and table out of the way, tried to batter down a wall at a place where no door existed, kicked and clawed the technician when he had the ill-luck to stand in my way. It took four of his fellows at the installation to cart me back to a safe distance, and I fought them at every step until my mind was free of the Great Unknown's thrall."

The account of his episode of insanity was all the more chilling because it came out in the translator's flat tones. Jennifer shivered. She bore Aissur Aissur Rus no great goodwill, the more so as he'd evidently been the one who instigated her kidnapping. But she would not have wished on anyone what the Great Unknown did to Foitani.

She asked, "When you were safe again, did you recall the insight you'd had within your radius of doom?"

"No, and that may be the worst of it. I still feel that if I returned there, I would *know* again; I gather others of my kind have had a similar reaction. But none ever succeeded in communicating this knowledge, and I doubt I would prove the lone exception." He whispered something in his own language. The translator made it come out as emotionlessly as everything else, but Jennifer supplied the exclamation point: "Oh, to be wrong!"

They went to see Pawasar Pawasar Ras, who fixed Aissur Aissur Rus with a black ball-bearing stare. "You have been advocating this course for some time."

"Yes, honored kin-group leader, I have," Aissur Aissur Rus said.

Pawasar Pawasar Ras turned to Jennifer. "Why do you take his part?"

"Because if you really do want answers about the Great Unknown and nothing you've tried has worked, then you'd better try something else. If you're not serious about this project, then you can go on doing the same old things for the next 28,000 years." She threw in the number with malice aforethought. Beside her, Aissur Aissur Rus's ears twitched, but he kept quiet. She finished, "Honored kin-group leader, you were serious enough about what your people are doing here to come to Gilver yourself. The Foitani from Rof Golan seem serious about this place, too. So why don't you do what plainly needs doing?"

Pawasar Pawasar Ras bared his teeth at her. She stood firm, as she had with Dargnil Dargnil Lin in the library. Finally Pawasar Pawasar Ras said, "Had the Great Ones encountered your species, human Jennifer, they would have made a point of exterminating it. I must say I feel a certain sympathy toward such an attitude myself."

"I'll take that for a compliment," Jennifer answered coolly. Aissur Aissur Rus's ears twitched again. Now it was Jennifer's turn to try to stare down Pawasar Pawasar Ras. "Are you going to

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do what needs doing, or is this whole project just a sham?''

''Honored kin-group leader, what the human means is that—'' Aissur Aissur Rus began.

''Don't soften what I said,'' Jennifer interrupted. ''I meant it. If your people were willing to invade human space to snatch me to investigate this thing, why aren't you willing to do a proper job?''

''As we have noted, you do not think kindly of our species,'' Pawasar Pawasar Ras said. ''Tell me this, then: why do you care whether our project succeeds or fails? Indeed, I would expect you to hope we fail, so that you might gain a measure of revenge thereby.''

Jennifer looked at the big blue alien with the same reluctant respect she'd had to give him after they first met at the Odern spaceport. ''You know which questions to ask, I must say. When your people first kidnapped me, I did hope you'd fail,'' she answered honestly. ''I've changed my mind, though, for two reasons. First, digging out the answers you need looks like the only way I'm going to get back to Saugus. And second, I just flat-out hate the idea of any job being done poorly when it could be done right.''

''At last, human Jennifer, you have found a characteristic the two of us share,'' Pawasar Pawasar Ras said. ''Very well, then, it shall be as you suggest. We shall undertake to open the tower that is the centerpiece of the Great Unknown. Should matters not go as you hope, however, remember that a share of the responsibility remains yours even if, as kin-group leader, I make the ultimate command decision here.''

''You sound as though you expect the tower'll start spitting out warriors from the age of the Great Ones, or something like that,'' Jennifer said. ''For heaven's sake, it's been sitting here ever since the Suicide Wars.''

''As you did, I will give two reasons for my concern, human Jennifer,'' Pawasar Pawasar Ras said. ''First, the Great Ones built to last, as witness the hyperdrive trap that nearly took us all on our journey here. And second, the Great Unknown remains active at least in some measure, as witness its state of preservation and the radius of doom that surrounds it. Opening the tower will be in the way of an experiment, and in a proper experiment one learns what one had not known before. I will not deny my fear at some of the things the Great Unknown may teach us.''

Jennifer thought about that. A line from a Middle English fantasy writer —was it Lovecraft? Howard?— floated through her mind: *Do not call up that which you cannot put down*. Maybe it was good advice.

She shook her head. If she didn't take the chance, she didn't think she'd ever see Saugus again. She was willing to take a lot of chances to get back to human space. No matter how big the tower in the middle of the Great Unknown was, she didn't think it could hold enough old-time Foitani to overrun the entire human section of the galaxy. After what Pawasar Pawasar Ras had said, she wasn't sure, but she didn't think so.

''Let's get on with it,'' she said.

''We will need to consult with some of our soldiers,'' Pawasar Pawasar Ras said. ''They will best be able to gauge

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the type and strength of explosive likely to penetrate the tower while doing the minimum amount of damage."

"Possibly Enfram Enfram Marf. He is a specialist in ordnance," Aissur Aissur Rus suggested.

"Whomever you say." Jennifer paused, wondering whether she should trot out her all-purpose question again. She decided to: "May I speak without causing offense through ignorance of your customs?"

Pawasar Pawasar Ras's and Aissur Aissur Rus's translators answered together: "Speak."

"I've met a good many Foitani by now. As far as I can tell, all of you have been males. If I'm mistaken, I beg your pardon, but if I'm not, why haven't I met any of your females?"

"As this question steps along, the claws of its feet press against delicate flesh," Pawasar Pawasar Ras said.

"Shall I attempt an answer, honored kin-group leader?" Aissur Aissur Rus asked.

"Please do," his boss answered.

Aissur Aissur Rus turned to Jennifer. She was ready to hear anything—perhaps even that storks brought baby Foitani from the lettuce patch like so much air freight. Aissur Aissur Rus said, "I know that in your species, human Jennifer, as in most, gender is fixed for the life of the individual. This is not so among us. During approximately our first thirty years of life, we are female; for the balance, we are male. Thus you will not see females in places of importance among us, as they, by their nature, cannot acquire sufficient experience to justify such placement."

"Oh," Jennifer said. That made a certain amount of sense. She decided to tweak the Foitani: "You are aware that I'm female."

"Indeed," Pawasar Pawasar Ras said, apparently relieved that someone else had done the talking about actual details. "You are, however, also of another species. The denigration implied by that far outweighs any relating to your gender."

"Oh," Jennifer said again, in a different tone of voice. The Foitani didn't need to look down their muzzles at her gender to keep her in her place.

Even Aissur Aissur Rus seemed relieved not to have to talk about gender any more. He quickly changed the subject: "Let us proceed to Enfram Enfram Marf, human Jennifer. He is our explosives expert here, as I said."

"All right." Jennifer smiled a little at finding the Foitani, for all their differences from mankind, so Victorian about the way their bodies worked. Had she not studied Middle English, she wouldn't have had a word to describe their attitude; the term had not come forward into Spanglish. Something occurred to her. "Did the Great Ones operate the same way you do, Aissur Aissur Rus?"

"Certainly." Aissur Aissur Rus drew himself up even taller than he was already, a paradigm of offended dignity. "They were Foitani and we are Foitani. How could disparity exist between us?"

"I didn't mean to make you angry," Jennifer said, on the whole sincerely—she liked Aissur Aissur Rus best of the Foitani she'd met. "I was just asking."

"Very well. I shall assume the slight

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was unintentional. Now let us proceed to Enfram Enfram Marf."

The Foitani explosives expert was taller but thinner than Aissur Aissur Rus. He had a scarred muzzle that made him easy to recognize. All the Foitani seemed predatory to Jennifer; Enfram Enfram Marf seemed predatory even for a Foitan. He all but salivated when Aissur Aissur Rus explained why they were there. "I do not believe it," he said several times. "How did you persuade Pawasar Pawasar Ras to let us use the power we have? I thought he would just let us sit here forever, doing nothing."

"The opinions and suggestions of the human Jennifer aided materially in getting him to modify his previous opinion," Aissur Aissur Rus said. That made Jennifer like him even better. Plenty of humans wouldn't have shared credit with a friend from their own species, let alone with an alien they'd hijacked.

Enfram Enfram Marf turned to stare at her. "This ugly little pink and white and yellow thing?" Jennifer heard through Aissur Aissur Rus's translator. "Pawasar Pawasar Ras listened to this sub-Foitani blob when he would not hear you? Our sphere's a strange place, and no mistake."

The contempt behind the colorless words made Jennifer realize she really had been dealing with what passed for interspecies diplomats among the Foitani. If Enfram Enfram Marf thought like the average Foitan in the street, no wonder the Great Ones hadn't worried about genocide.

She smiled sweetly at the ordnance officer (she knew the smile was wasted on him, but used it for her own satisfaction) and said, "I'm female, too. How do you like that?"

Had Enfram Enfram Marf been human, he would have turned purple. He drew back a leg, as if to kick Jennifer across the room. "Wait," Aissur Aissur Rus said before the leg could shoot forward. "The human is still of use to us."

"Why?" Enfram Enfram Marf retorted. "Now that we have Pawasar Pawasar Ras's permission to open up the Great Unknown, we don't need this thing to gather data for us. We can go back to using machines; they'll be able to bring artifacts out past the radius of doom so we can properly study them."

"If all goes well, yes," Aissur Aissur Rus said. "But all may not go well. Machines are less flexible than intelligent beings, even now. Moreover, we acquired the human Jennifer not so much to gather data as to interpret it. She's expert in a peculiar form of extrapolation by storytelling that humans developed long ago, which may give her unusual insight into the reasons the Great Ones created the Great Unknown as they did."

"How could this creature understand the Great Ones when we, their descendants, do not?" Enfram Enfram Marf demanded. But his leg returned to the floor. He bared his teeth, then went on, "Oh, very well, Aissur Aissur Rus, let it be as you say. I shall begin calculating the proper weight, shape, and composition of the charge, based on what we know of the thickness and material of the tower's outer wall."

"Excellent, Enfram Enfram Marf. That is what we require of you."

"Nice to know that I'm useful," Jennifer remarked as Aissur Aissur Rus led

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her down the corridor. "Otherwise you would have let him kick me into the middle of next week."

Aissur Aissur Rus paused, and looked down at Jennifer. After a moment, he said, "I will assume my translator should not have rendered that idiom so literally."

"Well, no," Jennifer admitted.

"Good. We did not believe humans capable of time travel. We are not able to travel in time ourselves, either, though there are some poorly understood indications that the Great Ones had that ability."

It was Jennifer's turn to stare. She had thought about pulling Aissur Aissur Rus's leg over what was indeed merely an idiom the translator program had missed—there wasn't a program around that didn't have a few of those annoying blank spots in it. Now she wondered if he wasn't telling her a tall tale to get even. The only trouble was, she didn't think Foitani minds—even that of Aissur Aissur Rus, who was the loosest, most freewheeling thinker she'd met among the aliens—worked that way.

She called him on it: "Time travel is as impossible—"

"—as a hyperdrive trap?" he interrupted. She opened her mouth, closed it again as she realized she had no good comeback to make. She thought of herself as quicker-witted than the Foitani, but this time Aissur Aissur Rus unquestionably got the last word.

The tracked sledge delivered the explosive charge against the side of the polished white stone, then rolled off. The charge clung to the stone. The sledge stopped a couple of hundred meters away. Jennifer and Greenberg crouched behind it, on the side facing away from the stone. Greenberg spoke into his communicator: "We're under cover, Enfram Enfram Marf."

The Foitani ordnance officer did not waste time replying. An instant later, a flat *craaack* rang out. It was much less dramatic than Jennifer had expected. She lifted her head. The stone panel had a neat, almost perfectly round hole in it, about a meter and a half across.

"He knows his stuff," she said, less than delighted about giving Enfram Enfram Marf any credit whatever.

"Explosives people tend to, at least the ones who live long enough to get a handle on what they're doing," Greenberg said. He spoke into the communicator again: "This was a good test, Enfram Enfram Marf. If your figures for the column are accurate, we won't have any trouble getting inside."

Again Enfram Enfram Marf did not reply. Jennifer said, "He doesn't think anyone who's not a Foitani is worth talking to."

"That's his problem. His bosses think I'm worth talking to, and they thought you were worth kidnapping so they could talk to you. I'm not going to lose a minute of sleep worrying about what the high and mighty Enfram Enfram Marf thinks of me."

Jennifer was sure he meant it. She admired his detachment, and wished she could share it. She asked, "How do you keep from taking what aliens say personally?"

"The same way I do with humans: I try to gauge whether the person who's talking has any idea of what he's talking about. A lot of humans are damn fools,

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and so are a lot of aliens, Enfram Enfram Marf included. Just because he knows his explosives, he thinks he knows everything. I don't know much, but I know he's wrong."

Jennifer grinned and clapped her hands. Greenberg gave her a curious look. She wondered how she was supposed to explain to him that his line of reasoning went back 3,500 years to the *Apology* of Socrates.

Before she had a chance to try, the sledge speaker spoke up again: "Humans Bernard and Jennifer, this is Thegun Thegun Nug speaking. We shall have a charge ready for placement tomorrow. You will then proceed to begin exploration of the tower of the Great Unknown, relaying to us such data as you uncover."

To Jennifer's way of thinking, Thegun Thegun Nug had an unpleasant habit of assuming that everything would be exactly as he wished just because he said so. Greenberg did not let that bother him. He said, "Yes, we'll start exploring for you, Thegun Thegun Nug. We'll all learn something."

"That is the desired outcome," Thegun Thegun Nug agreed.

"What I want to learn is how to get out of here," Jennifer said. For all she knew, the mike was still open. Thegun Thegun Nug didn't answer. She hadn't expected him to. He knew how she felt.

The two sledges purred away from the Foitani research base toward the Great Unknown. Enfram Enfram Marf's new shaped-charge device sat behind Bernard Greenberg. Jennifer was glad it didn't rest on her sledge. She didn't quite trust Enfram Enfram Marf not to touch a button and say it was an accident. A meter-and-a-half hole out of her middle wouldn't leave much. . . .

They'd only gone a couple of kilometers, barely even to the edge of the radius of doom, when a loud, warbling whistle began behind them. "What the devil is that?"

"It's a Foitani alarm," Greenberg answered.

"It sure alarms me."

Greenberg spoke into the communicator on the sledge: "Human Bernard to Foitani base: why have you switched on your alarms?" He repeated himself several times.

For a long time—more than a minute—no answer came. Jennifer began to wonder if the Foitani had forgotten about them. Then the cool tones of the translator came over the speaker: "Humans Bernard and Jennifer, this is Pawasar Pawasar Ras. I suggest you take cover as expeditiously as possible. Gilver is once more under attack from the savages of Rof Golan. Vectors of incoming ships indicate that they may attempt to land ground forces on Gilver, most probably with a view to assaulting or capturing the Great Unknown."

"We'd better head back," Jennifer said. Fliers sprang into the sky from the Foitani base. Cloven air shouted far behind them. Missiles leaped off launchers.

Then, from nowhere, a flier shrieked overhead at treetop height. A string of what might have been finned eggs fell from its belly. Had it sought the two sledges, it would have blasted them to bits. But its target was a hard point a few hundred meters to the west, between the humans and the base. Explo-

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sions smote Jennifer's ears. With an instinct she didn't know she had, she threw herself off her sledge and onto the roadway, flat on her belly.

More explosions came, some distant, some close enough to lift her off the ground and slam her back down. During one brief lull, she looked over and saw Greenberg beside her. She had no idea how or when he'd gotten there. Then more bombs fell. Shrapnel whispered overhead.

Greenberg put his mouth next to her ear. "We can't go back," he screamed through the din.

"We can't stay here, either," she screamed back. As if to underscore her words, a fragment of bomb casing went *spaang!* off the side of a sledge.

"Then we head for the Great Unknown," Greenberg said, still at the top of his lungs.

Jennifer thought it over, as well as she could think in the midst of chaos and terror. "Sounds good," she said. "Let's do it, if the bombing ever moves a little ways from us. It's the one place on the planet where the Foitani can't come after us."

"The ones from Odern can't, anyhow," Greenberg said. "We just have to hope that holds for the ones from Rof Golan, too."

"I wish you hadn't said that," Jennifer glanced up at her sledge. "I also wish we had more kibbles and water." They'd planned on staying at the Great Unknown for a couple of days if they succeeded in getting into the tower, so they weren't without supplies. She looked up at the plastic bag of kibbles again, and fought back a laugh. She'd never imagined a day would come when she wanted more of them than she had. She'd never imagined most of the things that had happened to her since the day the Foitani walked into her class at Saugus University.

More bombs struck, so close that she felt the impact with her whole body much more than she heard it. She and Greenberg clutched each other, life clinging to life in the middle of mechanized death. He shouted something at her. She knew that, but she was too stunned and deafened to tell what it was. She looked at him, shook her head.

"I love you," he said again. She still could not hear him, but his lips were easy to read.

"Why are you telling me now?" she said, slowly and with exaggerated movements of her own lips so he could follow. "We're liable to get blown to bits any minute."

He nodded vehemently. "That's just why. I didn't want to die without letting you know."

"Oh." She supposed it was terribly romantic, but she needed to be able to think about it. Thought was impossible here; she was battered and deafened and more frightened than she'd ever been in her life. Holding onto him still seemed like a good idea, so she kept on doing it.

The explosions grew more distant. Jennifer detached herself from Greenberg, far enough to peer past the front of the sledge. Dirt rose in graceful fountains all around the research base. The base fought back; close-in guns chattered maniacally, blasting bombs and incoming missiles before they struck home.

"If we're ever going to move, this

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is probably the time to do it," she told Greenberg. "Nobody seems to be paying attention to us."

"Let's go, then," he said. "The farther inside the radius of insanity we are, the better I'll like it." They scrambled onto their sledges and sent them dashing ahead at their best—and only—forward speed. No healthy Foitan would have had the least trouble running them down.

Greenberg looked over his shoulder. "Good thing we didn't head back to the base," he said. Jennifer looked back, too. A troop-carrier had landed right about where they would have been if they'd tried to reverse their course. Foitani—presumably Foitani from Rof Golan—leaped out of it, scrambled for cover. They started firing with automatic weapons heavier than anything a human could have carried.

"I wouldn't have wanted to meet them up close, no," Jennifer admitted. *Meet* wasn't quite the right word, she thought. The Foitani didn't look like the sort who would have waited for formal introductions before they started shooting.

The sledges crawled along. The invaders seemed too busy trying to blast the research base off the face of Gilver to bother doing anything about them. Jennifer wondered if that was too good to last. A moment later, she wished she hadn't, because it was. Something *crack*ed past her ear. Then another something smacked off the rear facing of the sledge, hard enough to make it shudder under her. It kept running, though.

She turned around again. A couple of big blue aliens were bounding after her and Greenberg. As she'd feared, they ran faster than the sledges. Nothing grew in the area of the Great Unknown. There was no place to hide, save possibly behind the massive columns of the colonnade. The only weapon she had was her stunner, which might make a Foitani scratch but assuredly would not stop him. In any case, the soldiers' hand weapons far outranged the feeble thing.

Greenberg had seen the Foitani, too. If he felt the same choking despair that cast its pall over her, he did not show it. In fact, he stood up on his sledge (it was slow enough and smooth enough to make that safe enough) and jumped up and down thumbing his nose at them. That only made them run harder—and all at once, Jennifer realized he wanted exactly that. "You're a genius, Bernard!" she shouted. She stood up on her sledge too.

The Foitani from Rof Golan kept coming. All too soon, they were only a couple of hundred meters behind the sledges. The closer they drew, the more easily Jennifer could see they were not the same as Foitani from Odern. They were taller and leaner and more gray than blue. Their ears were larger. So were their muzzles—and their teeth. They had red marbles for eyes, not black ones. That made them seem all the fiercer as they bore down on the humans.

Their clawed feet slapped on the smooth stone of the processionway. Jennifer heard their harsh breathing closer, ever closer. She reached into her belt pouch for her stunner, though she knew a steak knife would have done more good. She put away the stunner. If these Foitani had decided to take them pris-

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oner instead of slaying them out of hand, she would not try to change their minds.

The Foitani caught up with the sledges. They even smelled different from the Foitani of Odern—sharper, like ripe cheese, Jennifer thought as she waited to be seized. The Rof Golani Foitani ran past her and Greenberg, one on either side of their sledges. They paid no attention whatever to the humans. Their red eyes were only on the tower ahead. Like two big machines, they pounded toward it.

Jennifer watched their backs recede ahead. "I think we may take it as proven that the Great Unknown affects more than one type of Foitani descendant," she said. She was proud of herself. The sentence came out as clearly as if she were dictating an academic paper into the Middle English Scholars Association datanet.

Greenberg gave her an odd look. "Yes, I think we may," he answered, half a beat late. "I think it's a good thing, too."

"So do I." Jennifer steered her sled up next to his. She reached across and took his hand. Her own palm was cold and trembling. With the vibration of the two sledges, she couldn't tell if he also had the shakes, but he felt no warmer. After a moment, she added, "That was good thinking, luring them on into the zone of insanity. Now all they care about is the Great Unknown. They can keep it, too, as far as I'm concerned. I don't think I was made to be a soldier."

"Neither was I," Greenberg said. "I kept thinking about getting behind you and setting off Enfram Enfram Marf's shaped charge at the Foitani. By the time I decided it wasn't a good idea, they'd already gone by us."

"You still did better than I did," she said. "I forgot all about the stupid thing."

"That's not so good, Jennifer," he said seriously. "You should never forget about anything."

The sledges ground on toward the central tower. Jennifer kept looking back at the research base of the Foitani from Odern. The one good thing about the fighting that continued all around it was that the Foitani from Rof Golan weren't using nuclear weapons, as they had when they attacked from space. Maybe now, she thought, they were more interested in conquest than in annihilation. She hoped they would go on thinking that way; she had no confidence in the Great Unknown's ability to keep fallout from the local atmosphere.

Several other Foitani from Rof Golan strode the processionway behind the first two. None passed the sledges, which by then were more than halfway from the outer edge of the radius of doom to the central tower. None shot at the sledges, either, for which Jennifer was duly grateful. A couple of kilometers from the tower, the sledges, slow but mechanically steady, repassed the first two Foitani soldiers. Their gray-blue fur was damp with sweat; their tongues lolled from their mouths. They did not glance at the machines or the humans aboard them, but kept trudging toward the tower at the best speed they could muster.

The tower grew closer and closer. The two sledges stopped a couple of

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meters away. Greenberg climbed down from his sledge, lifted the shaped charge Enfram Enfram Marf had given him, and carried it to the side of the immense white structure. He pressed it against the stone. Jennifer wondered if it would stick, as it had against the practice slab of stone. The material of the Great Unknown seemed much more than simple white marble. But stick the charge did.

Greenberg went back to the sledge, called the research base: "We have the entry charge in place. Please advise if we should proceed, under the circumstances." Only static came from the speaker. Either no one at the base was listening or the Rof Golani were jamming the channel. Greenberg looked at Jennifer. "What do you think?"

"I think we ought to blow it," she said without hesitation. "We're never going to have a better chance than this. I just hope it's not all for nothing anyway—if the Foitani from Rof Golan win, what's going to happen to the *Harold Meeker*?"

"That's such a good question, I've done my best not to think about it." Greenberg made a sour face. He ran wire from the charge back to the detonator. "We have a couple of hundred meters to retreat. Let's use them." The sledges went into reverse until the wire began to grow taut.

Greenberg dismounted again, and got behind his sledge. Jennifer took cover too. She said, "I'm just glad this thing doesn't have to be set off by radio from the base, the way the practice charge did."

He let out a wry chuckle. "That would rather ruin our day's work, wouldn't it?"

"You might say so, yes," she answered, trying to match him dry for dry. She heard the slap-slap-slap of Foitani feet on the processionway. The first two soldiers from Rof Golan were getting close again. "If you're going to do it, you'd better do it now."

Greenberg glanced back toward the Foitani. He nodded. "Right you are." He brought his thumb down on the blue firing button. He grunted—squeezing the contact closed took considerable effort. Not only were Foitani stronger than people to begin with, the firing button was rigged so it could not go off by accident.

After the bombardment she'd been through, Jennifer found the detonation of the shaped charge an anticlimax. Unlike munitions makers, blasting experts do not make their devices as strong as possible, only just strong enough to do a particular job. Even in quiet circumstances, the blast would hardly have made her jump.

She looked up over the top of the sledge. Just as in the practice run, Enfram Enfram Marf's charge had blown a neat round hole in the white stone of the tower. Blackness lay beyond it.

Greenberg looked up, too, then grabbed the communicator. "Calling the research base. I don't know whether you can see it—for that matter, I don't know if you can hear me—but we have succeeded in making a breach in the base of the column at the center of the Great Unknown."

"This is Pawasar Pawasar Ras, human Bernard," the comm answered. Jennifer jumped—she hadn't expected a reply. Pawasar Pawasar Ras went on, "I regret that our project has been dis-

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rupted by the perfidious attack from the wretched pseudo-Foitani of Rof Golan. Nevertheless, we do continue to keep you and the Great Unknown under observation. We discern no evidence of damage to the column."

Jennifer looked up over the sledge again. So did Greenberg. "I see a hole," he said. "Do you see a hole?" She nodded. "Good," he told her, then spoke into the communicator once more: "Honored kin-group leader, both of us think there's a hole in the side of that building. We're going to test it experimentally. How much do you want to bet that we get inside?"

"As a matter of fact, we may not be the first ones to do the testing," Jennifer added. The two Foitani from Rof Golan, still paying no attention to the humans or their sledges, tramped past them toward the tower.

"If you are somehow correct and there is an opening I cannot perceive, you must not permit the Rof Golani to exploit it. Use whatever means necessary to prevent their gaining entry," Pawasar Pawasar Ras said. The translator didn't let him sound agitated, no matter how upset he really was.

"How are we supposed to stop them?" Jennifer asked.

"Use whatever means necessary," Pawasar Pawasar Ras repeated.

Jennifer looked at the Foitani. Each of them was more than a meter and a half taller than she was. Each of them carried a weapon that could kill her at five times the range she could even make him itch. She looked at Greenberg. He'd been looking at the Foitani, too. Now his gaze swung back to her. She said, "Bullshit."

He nodded. "You'd better believe it." He spoke into the communicator: "Honored kin-group leader, we didn't sign up with you to commit suicide. You ought to know, though, that the Foitani from Rof Golan seem to be suffering from the same thing your people do when they get too close to the Great Unknown. They don't seem to be in any shape to relay whatever they learn to anybody."

A long silence followed. At last Pawasar Pawasar Ras said, "There may be some truth to this comment. Nevertheless—"

"No," Greenberg broke in, adding, "It's too late anyhow, honored kin-group leader. The first two Rof Golani have reached the tower."

The big blue-gray Foitani dropped their weapons to press themselves against the smooth white stone of the wall. They were only five or six meters from the hole in its side, but gave no sign of noticing it. For several minutes, they seemed content just to stand there. Then, not getting more than a meter or so away from the edge of the wall, they began walking parallel to it, one of them behind the other.

They walked right past the hole. Their feet scuffed through the pieces of stone the shaped charge had blasted loose. They took no notice of them, either; as far as they were concerned, the area was as perfectly smooth as any other part of the processionway.

Greenberg turned to Jennifer. "I will be damned. They *can't* see that it's there."

Spanglish failed her. She fell back into Middle English: "Curiouser and curiouser." Then she said, "It makes

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me wonder whether the hole really is there after all."

"I can tell you two things about that," he answered. "Thing number one is that we know the Great Unknown makes Foitani crazy and we don't think it does that to us. Thing number two is, we can go and find out, so let's go and find out."

He stood up and walked toward the hole. Jennifer followed him. She saw the chunks of white stone that lay in front of it. Pretty soon, she kicked one of them. She felt it as her boot collided with it, heard it rattle away. All the same, she had the feeling she was approaching one of those holes quickly painted on the side of a mountain in an ancient animated fantasy video, the sort that would let whoever painted them go through and then turn solid again so a pursuer smashed himself against hard, hard rock. She stretched a hand out in front of her so she wouldn't hurt herself if the opening ahead proved not to be an opening.

She kicked another fragment of stone out of the way. This one clicked off the side of the tower. The noise seemed no different from the one the first stone had made, but the Foitani from Rof Golan hadn't noticed that one. They noticed this time. They spun around. Their red eyes blazed. They'd let their weapons fall when they came up to the column, but they still had fangs and claws and bulk. Roaring like beasts of prey, they charged at the two humans.

"Uh-oh," Greenberg said, which summed things up well enough. Running away from the Foitani didn't seem as though it would help. Greenberg and Jennifer ran for the hole instead. He shoved her in ahead of him. The rough stone at the edge of the hole ripped the knees out of her coveralls as she scrambled through. Greenberg dove after her scant seconds later, just ahead of the Foitani.

By then she had a fist-sized rock in her hand, ready to fling in the face of one of the aliens. At such close range, she thought, she might even hurt him. Greenberg scrabbled around in the darkness for a rock for himself.

The Foitani came up to the hole and stared at it. They said something in their own language. Even without the moderating effect of the translator, Foitani from Odern sounded calm whether they were or not. As Jennifer had heard over the *Harold Meeker*'s radio, Foitani from Rof Golan yelled even when there was nothing worth yelling about. These two screamed back and forth at each other. Jennifer didn't need a translator to guess they where saying something like, "Where did the funny-looking critters go?"

Then she drew back her arm again to throw that rock, for a Foitan reached toward the hole. Those big clawed hands came straight for her. If she waited any longer, she thought, the Foitan would pluck her straight out of her hiding place.

But his hands stopped, right where the surface of the wall had been before Enfram Enfram Marf's charge bit through it. Jennifer watched his palms flatten out against what to him was plainly still a solid surface. He turned to his comrade, gestured as if to say, *Come on: you try it.*

The other Foitan tried it. His hands stopped where the wall should have

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been, too. He squawked something to his friend. Friend squawked back. They walked off, both of them shaking their heads.

Greenberg indulged in the luxury of a long, heartfelt, "Whew!" Then he said, "You don't know how glad I am that they'd put down their guns. I didn't care to find out whether bullets believed in hallucinations."

"Urk." Jennifer thought of that. After a moment, she added, "Who says I don't know how glad you are?"

Greenberg spoke into the communicator: "Research base, we are inside the central tower to the Great Unknown. I say again, we are inside." He repeated himself several times, but got no answer. He stuck the comm in his pocket. "Maybe the Foitani from Rof Golan are jamming again."

"Or maybe Pawasar Pawasar Ras and his friends can't hear you because you're calling from inside the tower and don't exist any more as far as they're concerned," Jennifer said.

He gave her a dirty look. "I was right after all when I first got to know you—reading all that ancient science fiction has twisted your mind."

"People used to say that about it then, too." Jennifer took out a hand torch, clicked it on. "As long as we're here, shall we see what *here* is like?"

Greenberg also got out a light. "We don't want to shine these out through the hole," he told her. "If the effect that keeps the Foitani from seeing it is like a one-way mirror, bright light from this side could ruin it."

"All right," Jennifer said, "but if the effect is like a one-way mirror, how come the Foitani couldn't feel their way in, either?"

"I don't know. I'm just glad they couldn't. Aren't you?"

"Now that you mention it, yes." Jennifer turned around and played the torch on the far wall of the chamber. However disagreeable he was, Enfram Enfram Marf had been an artist with his shaped charge: that wall, only four or five meters from the blast, was hardly even scorched. The chamber itself was bare, but for the fragments of stone from the outer wall.

"We're lucky," Greenberg said. "Looks like we didn't damage anything much in here."

"We didn't, did we?" Jennifer looked around again. "This room is so bare, it's almost as if they emptied it out on purpose, knowing this was where we'd break in." The words hung in the air after she spoke them. She deliberately shook her head. "It couldn't be. The Suicide Wars happened 28,000 years ago."

"But what's been keeping the Great Unknown alive all that time?" Greenberg said, a note of doubt in his voice. "The Great Ones had a higher technology than ours."

"It couldn't be," Jennifer repeated.

What happened next made her think of the closing line of a classic Clarke story: "One by one, without any fuss, the stars were going out." This surprise was not on such a cosmic scale, but it more than sufficed for the occasion. One by one, without any fuss, the ceiling lights in the chamber came on.

"Oh, my," Jennifer whispered, and then, a moment later, "Oh, no." Nothing she'd seen about the empire of the

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Great Ones made her admire them or want them back. Much of what she'd seen had scared her spitless. And now an artifact—a big artifact—from the time of that empire was indubitably not just alive but awake. "Maybe if we leave, it'll go back to sleep," she said. "I think I'd rather face the Rof Golani than—this."

"You've got a point," said Greenberg, who had to have been thinking along with her. But when they turned around to scramble out through the hole the shaped charge had blasted, they discovered it was no longer there. The inner wall looked as if it had stayed undisturbed for 28,000 Foitani years.

Jennifer walked over to the wall, patted it much as the soldiers of Rof Golan had from the outside. It felt as solid as it looked. "Is it real?" she asked.

"What's 'real'?" Greenberg countered. People had been wondering that since long before the days of Pontius Pilate, Jennifer thought, and generally, like Pilate, washed their hands of the question. Before she could say that out loud, Greenberg went on, "It's real enough to keep us in here, which is what counts at the moment."

"I can't argue with you there," Jennifer said. None of the walls now, so far as she could tell, held any openings. But with the Foitani, that wasn't necessarily the way things were. If the Great Ones were as adept at memory-metal technology as their distant descendants from Odern, the chamber could have had a dozen doorways, or two dozen, or three.

Bernard Greenberg evidently reached the same conclusion at the same time. He went over to the wall opposite the reconstituted one that led to the outside, began rapping on it here and there, as the Foitani did when they used their unnerving entranceways. For all the rapping, though, nothing happened.

"Try higher up," Jennifer suggested. "They're bigger than we are, so the sensitive area should be farther off the ground than if we'd built this thing."

"If humans had built this thing, it would have come with holovid instructions," Greenberg said. All the same, he raised his hand most of a meter. That produced results. In fact, it produced them twice: two doors opened up, less than a meter apart. They led into different rooms, one into a chamber much like the one in which Jennifer and he stood, the other into a long hallway.

"The lady or the tiger," Jennifer murmured. One trouble with that was that Greenberg didn't know what she was talking about. Another was that the choice was more likely to be between two tigers. She turned to Greenberg. "Which way do you think we should go?"

He plucked at his graying beard. "That room looks like more of the same. The hall is something different. Let's try it and see what happens."

"Makes as much sense as anything," Jennifer said, "which isn't much. All right, let's do it."

They stepped into the hall together. Jennifer's hand was on her useless stunner. Years of reading Middle English SF left her ready for anything, from Niven-style matter transporters to an extravaganza of lights out of the classic video *2001*. Human technology was as advanced as any in this part of the galaxy . . . except, evidently, that of the

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Great Ones. Not knowing what to expect left Jennifer more than a little uneasy. She reached out to Greenberg, and was not surprised to find him also reaching out to her.

They didn't find themselves all at once in another part of the building. They weren't surrounded and overwhelmed by flashing lights. The hallway was just a hallway. But when Jennifer looked back over her shoulder, the door that had let them in was gone.

Every so often, Greenberg reached up to rap on the hallway wall. For more than fifty meters, nothing happened when he did; he must not have been picking the right spots. Then, with the unnerving suddenness of Foitani doors, a blank space appeared where only wall had been.

Greenberg and Jennifer both jumped. When she looked into the room that instant door revealed, Jennifer felt like jumping again. The chamber held an astonishingly realistic statue or holovid slide of a Foitan.

"He's not quite the same as the ones from Odern or from Rof Golan," Greenberg said.

"No," Jennifer agreed. The image of the Great One was a little taller than either of the descendant races she'd met. Its fur was green-blue, not the gray-blue of the Rof Golani or the plain blue-blue of the Foitani from Odern. The shape of the torso was also a little different. The legs were rather longer. The Great One might not have been of the same species as the modern Foitani; it definitely was of the same genus.

"Everything we're doing in here seems stage-managed somehow," Greenberg said. "We've known all along that this is a center for the Great Ones. What else are we supposed to learn from seeing one almost in the flesh?"

"I don't know," Jennifer answered. "Maybe that—" She stopped with a gurgle as the statue or holovid slide of the imperial Foitan turned its head and looked straight at her.

Without conscious thought, Jennifer pointed her stunner at the—no, it wasn't a statue—at the imperial Foitan and thumbed the firing button. Only later did she pause to wonder why she'd done anything so aggressively futile. If the Great One was a holovid projection or a robot simulacrum, the beam would do nothing whatsoever to it. Even if he was somehow alive, the most she could do was make him itch. All she knew was that she wanted a weapon, and the stunner was the best she had.

The Great One scratched vehemently, all over. "It's real," Greenberg said. He sounded as if he was accusing Jennifer.

"I'm glad you thought it couldn't be, too," she said. She put the stunner away. Enraging something with carnivore teeth and four times her weight didn't seem like a good idea.

The Foitan walked toward her. He didn't act enraged, just curious. He said something in his own language. The words didn't sound too different from the ones the Foitani from Odern used. The only trouble was, without a translator she couldn't understand any of them. She spread her hands, shook her head, and bared her teeth in a Foitani-style frown. "I wish I could wiggle my ears," she whispered to Greenberg.

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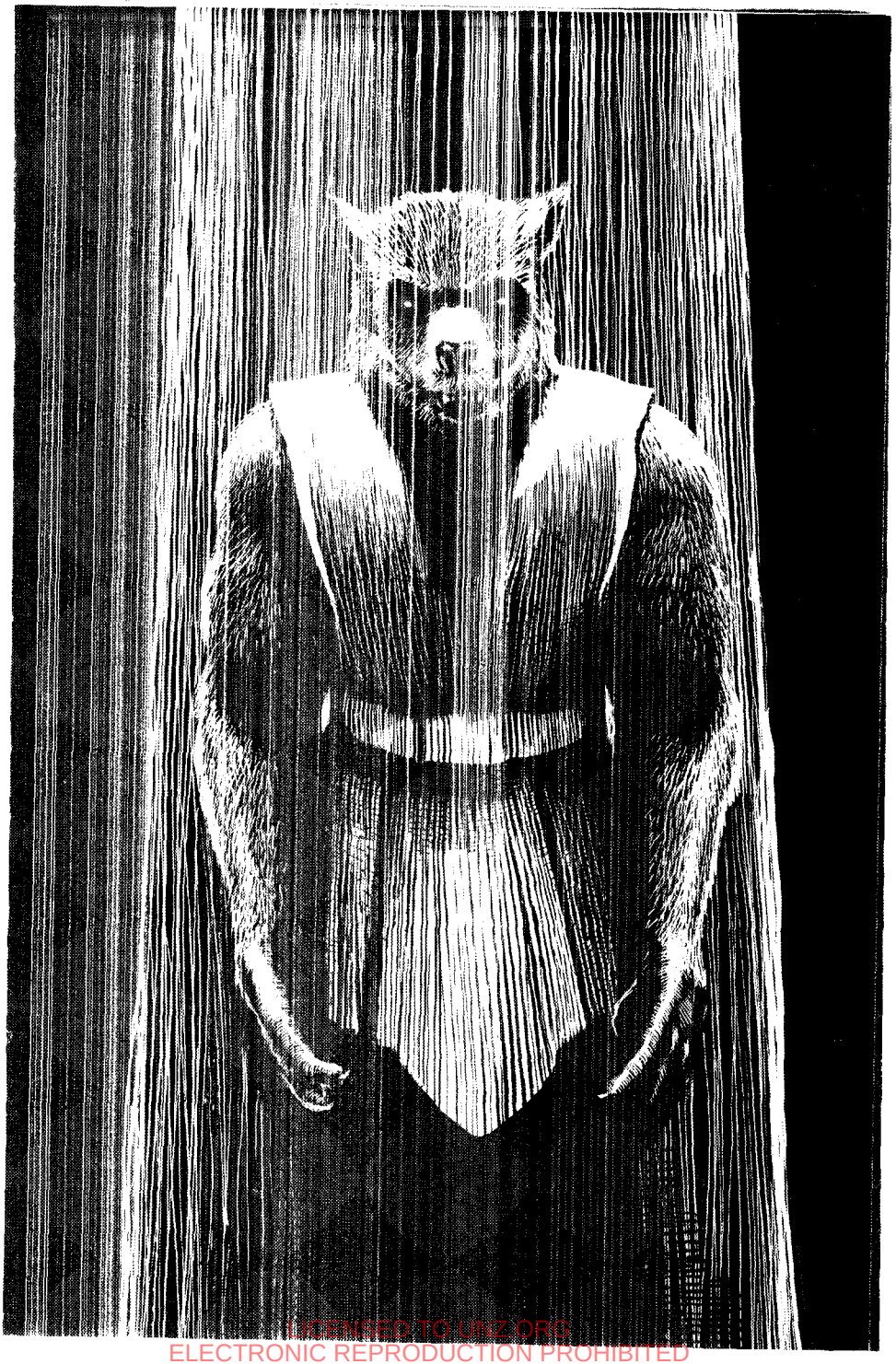

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A look of intense concentration crossed his face. His ears did wiggle, close to a centimeter to and fro. Jennifer stared at him. His smile was sheepish and proud at the same time. He said, "I haven't done that since I was a kid. I wasn't sure I still could."

Jennifer wasn't sure whether the ear-wiggling did any good. The Great One stopped just in front of her, bent his knees so his eyes were on a level with hers. Those eyes were not quite the jet black of the eyes of a Foitani from Odern; they were a deep, deep green-blue, an intensification of the shade of the Great One's skin and pelt. The color would have been stunning in a human woman's eyes. Here, it was simply alien.

"We came in peace," Jennifer said, knowing the alien would not understand. She also realized it was barely true; they'd blasted their way into the tower, and a good-sized battle was going on just outside the Great Unknown's radius of insanity. For that matter, more than a few armed Foitani from Rof Golan were inside the radius of doom, even if at the moment they were in no state to use their weapons.

Greenberg held his hands in front of him, palms out. Many races used that gesture to show they had peaceful intentions. Jennifer tried to remember if she'd seen it among the Foitani from Odern. She didn't think so. As far as she could tell, though, Foitani in general didn't have peaceful intentions all that often.

The Great One kept studying Greenberg and her. A visual examination didn't seem to satisfy the alien. The Great One sniffed at them, too, with as little regard for their modesty as a dog would have given them. Jennifer wished she hadn't spent the last several hours sweating and terrified after the Foitani from Rof Golan attacked the research base of their cousins from Odern.

Finally, to her relief, the Great One straightened up. He spoke a few words into the air. Holovid pictures of alien races appeared in front of him, one after another, as if in a video collage. Jennifer recognized a couple of species, but most were strange to her. Then the Foitan spoke again. The cavalcade of images stopped—with a pair of humans hanging in midair before the Great One.

"That's impossible," Jennifer whispered to Greenberg.

"Maybe not," he whispered back. "I've heard it claimed in traders' bars that the Foitani made it all the way to Earth. I never thought it was anything but a bar story, though."

The humans in the holovid display—a man and a woman—were a lot grimier than Jennifer had worried about being. They wore furs. The man carried a wooden spear with a stone point attached with sinews. The woman clutched a stone knife, or it might have been a scraper. They both looked scared to death.

The Great One examined them as carefully as he had Jennifer and Greenberg. He even sniffed them in the same way, as if to confirm by another sense that they were of the same type. That puzzled Jennifer. Could a holovid come with a scent attachment? She supposed so, for a race with a sense of smell more sensitive than humanity's. On the other hand—

"Bernard," she whispered, "do you

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think those poor cave people could somehow still be alive in here?''

He started to shake his head, then stopped. ''I don't know,'' he said slowly. ''The Foitan sure seems to be. After that, all bets are off.''

Jennifer wondered if the tower was some kind of Foitani museum—or zoo. At first, no doubt because she'd seen the two humans, the idea was horrifying. Then she remembered the notion she'd had the first time she came up to the tower, of countless aliens going in and never coming out. Imagining a museum or zoo was a lot more comfortable than thinking about—what was the Middle English expression? A Final Solution, that was it.

The Foitan spoke to the air again. The humans it had called up disappeared once more, either back into data storage or storage of a more literal sort. The Great One gave Jennifer and Greenberg another once-over. He bared his teeth at them in a Foitani frown. ''Wondering what we're doing here,'' Greenberg guessed.

''I'll bet you're right,'' Jennifer said. ''Earth is a long, long way from Gilver. What are the odds of cave people ending up here on their own and on the loose?'' Something else occurred to her. ''I wonder if the Foitan knows he's been here 28,000 years.''

Greenberg hissed. ''That's a real good question. I wish I had a real good answer.''

''I wish I did, too.''

The Foitan came out of his study. He walked over to the far wall of the chamber, rapped on it. This time it wasn't a door that opened, only a drawer-sized space. The Great One reached in, pulled something out, pointed it at Jennifer and Greenberg. By the way he handled it, it was obviously a weapon.

''Oh, shit,'' Greenberg said softly. ''Whether it's 28,000 years or the day before yesterday, the breed doesn't seem to have changed much some ways, does it? Oh, shit,'' he repeated.

Jennifer would have looked for better last words than that. But the Great One seemed to have second thoughts. Instead of firing, he gestured peremptorily with the weapon. ''I'm tired of being ordered around by Foitani,'' Jennifer said. With very little choice, however, she went down the hall in the direction the Great One indicated.

After about twenty meters, the Foitan stopped her and Greenberg. Another rap on the wall produced another doorway. The Great One ordered the humans into the new chamber. It reminded Jennifer of nothing so much as the library setup back on Odern: it was full of strange-looking holovid gear and computer equipment. Greenberg found another name for it: ''Command post,'' he said.

His proved the better guess. The Great One said something. A bank of screens came to life: the view immediately around the tower at ground level. More than one screen showed gray-blue Foitani from Rof Golan pressed up against the side of the building. Some still carried the arms they had brought to Gilver to use against the Foitani from Odern. All of them, armed or not, had the lost-soul look of Foitani under the influence of the Great Unknown.

The Great One had seemed almost godlike in competence and confidence. Now for the first time Jennifer saw him discomfited. He stared at his Rof Golani

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umpty-greatgrandscions as if he could not believe, did not want to believe, his eyes. She wondered what the Great One thought of those distorted versions of himself, versions made all the more grotesque by their obvious insanity.

At a shouted command, the Great One shifted to a view that had to have come from the top of the tower. Far off in the distance, Jennifer saw the spaceport by the research base of the Foitani from Odern. She also saw atmospheric fliers, tiny as specks in the screen, diving to attack the base.

One exploded in midair. The burst of light drew the Great One's notice. The magnification of the pickup increased. Now small-arms flashes were plainly visible. Jennifer tried to figure out what was going on. The Foitani from Odern—*her* Foitani—seemed to have established a defensive perimeter against their distant cousins from Rof Golan. As she watched, a missile streaked out from the base to blow up a Rof Golani armored vehicle.

The Great One watched, too—in horror, if Jennifer was any judge. When the Foitan spoke again, alarms started yammering. Alarm ran through Jennifer, too. Not so long ago, she'd scoffingly suggested to Pawasar Pawasar Ras that the tower might be full of armed Great Ones waiting to get loose. Now she didn't feel like scoffing any more.

Her own personal Great One didn't wait for any of his hypothetical relatives to arrive. Another wave of his weapon sent Jennifer and Greenberg back down the hall the way they had come. He marched them past the chamber in which they'd found him, all the way to the end of the corridor. An offhand, almost contemptuous rap on the wall produced the doorway Greenberg had found after so much effort. The Great One's weapon ordered the humans back into the room by way of which they'd entered the tower.

The Great One looked at the outer wall. Jennifer wondered if he saw it smooth and unblemished or if he could tell the hole from the shaped charge was there. Pieces of stone from the explosion still littered the floor. If the Great One thought that wall was smooth and unblemished, he'd have the devil's own time figuring out how the broken rock got there.

Several other Great Ones came rushing into the room. They were as like the first one as so many peas in a pod — almost even down to color, Jennifer thought irrelevantly. They were all armed, too, with weapons identical to the one the first old-time Foitan carried. One of them pointed his weapon at the outer wall. Jennifer didn't see him pull a trigger or press a button, but suddenly the hole—or a hole—was visible to her again.

"Did he make a new opening, or is that the same one Enfram Enfram Marf's charge blasted?" she asked Greenberg.

"I think it's ours," he answered, his eyes wide. "What does that make the Foitan's gun, though? An illusion-piercer? An illusion-creator?"

"Whatever it is, I don't want to be on the wrong end of it. If it makes me think I'm dead, I have the bad feeling I'd really end up that way."

"Me, too." Greenberg reached out to take her hand. She squeezed back. The contact was reassuring. She knew — she thought she knew—it was real.

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A Great One stuck his head through the hole. It was barely wide enough for his shoulders to go through, but he managed to squeeze out. Jennifer wished Pawasar Pawasar Ras hadn't listened to her or to Aissur Aissur Rus. Here were the warriors of a long-forgotten day, free on Gilver once more.

One of the Great Ones pointed his weapon at Jennifer and Greenberg. He urged them toward the hole they'd made. They went. Greenberg scrambled out first. Jennifer came after him a moment later.

The Great One goosed her with his weapon to make her go faster. She squawked and almost fell as she popped out of the hole. Greenberg helped steady her, moved her away from the opening before the next Foitan came through and stepped on her.

Imperial Foitani kept emerging. Jennifer wondered if the alarm had rung all through the tower, and how many Great Ones had been in suspended animation or whatever they used. She thought again of Pawasar Pawasar Ras's worries, and how she'd pooh-poohed them. If she ever got the chance, she'd apologize to the kin-group leader.

No Foitani from Rof Golan had been within a couple of hundred meters of where the Great Ones were coming out. The gray-blue soldiers, caught in the spell of the Great Unknown, gaped as their green-blue forebears came out of what might have looked to them like solid rock.

Jennifer waited for the Rof Golani to fall to their knees and worship the returned Great Ones, or to perform some equivalent ritual. The Rof Golani pointed at the newcomers, shouted among themselves. One of them yelled something toward the revived imperial Foitani. A Great One answered. Without hesitation, the Foitani from Rof Golan began running toward the Foitani who had come out of the tower.

And, without hesitation, the Great Ones methodically began shooting them down. Most of the Foitani from Rof Golan were too befuddled to use their own weapons, but their bared teeth, outstretched claws, and bellows of fury said what they thought of the Great Ones. But that wholehearted hatred availed them not at all, for the imperial Foitani calmly continued their massacre.

One Rof Golani somehow kept enough presence of mind to remember he carried a weapon more lethal than those with which he'd been born. Bullets ricocheted from the wall just above the Great Ones's heads. Jennifer and Greenberg threw themselves flat. A moment later, an imperial Foitan killed the only gray-blue soldier who'd seriously tried to fight back.

Slowly, Jennifer got to her feet. The precinct that contained the Great Unknown seemed to sway around her. Her view of the Foitani was rocking, too. Far from reverencing the Great Ones, the Foitani from Rof Golan had tried to kill them on sight. The Great Ones hadn't wasted any time returning the favor, either, and by all indications so far, they were a lot deadlier than the Rof Golani.

An old-time Foitan walked over to the nearest Rof Golani corpse and stared down at it. Jennifer wished she was better at reading Foitani facial expressions. Then the Foitan removed all doubt about

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what he was thinking. As Enfram Enfram Marf had with Jennifer, he drew back his leg for a kick. Unlike Enfram Enfram Marf, he didn't stop himself. He kicked the dead Rof Golani as hard as he could. The body had to weigh something close to two hundred kilos. The kick rolled it over, twice.

Several other Great Ones abused the bodies of the Foitani from Rof Golan. One picked up the small-arm the Rof Golani had managed to fire. He examined it for more than a minute, then threw it aside with unmistakable scorn. His own hand weapon emitted a beam of some sort; but for being dead, the Rof Golani looked fine.

Off in the western distance, the explosions round the research base of the Foitani from Odern kept rumbling. Fliers clashed above it, Rof Golani attacking, Foitani from Odern defending. A Great One pointed his weapon at one of those fliers. It was more than a dozen kilometers away, but it twisted in midair, crashed to the ground with a flash of purple light.

The rest of the old-time Foitani began swatting fliers out of the air as easily as if they'd been flies. Jennifer watched in appalled perplexity as the machines tumbled. "What's going on?" she demanded of Bernard Greenberg, who had no more answers than she did. "The Foitani from Odern practically worshiped the ground the Great Ones used to live on. No matter what they said about the Rof Golani, they never said the Rof Golani hated the Great Ones, either. But they do." She looked at the sprawled corpses, shuddered, looked away. "And the Great Ones hate them, too. Otherwise, they wouldn't be doing—this." She spread her hands in an all-encompassing gesture.

"Tell me about it," he said. He looked away from the carnage, too. "From what we've seen of the way Foitani treat other races, I'm glad they didn't just shoot us down without asking questions first."

One of the Great Ones swung his head around to glare at the two humans. By the way he hefted his weapon, he wasn't far from doing what Greenberg had feared. He wrapped a hand around his muzzle so that it closed his mouth, pointed first at Jennifer, then at Greenberg. *Shut up*, she figured out, and obeyed. Greenberg didn't say anything more, either.

The old-time Foitani—by now a couple of dozen of them might have been outside the tower—spread out into what looked like a skirmish line. One of them pointed west, toward the sound of fighting . . . and toward the research base of the Foitani from Odern. The whole band started moving in that direction.

By the way they set out, fifteen kilometers was a stroll in the park for them. Jennifer looked longingly toward her sledge. The Foitan who'd warned her to be quiet gestured with his weapon —*come along*. She sighed and went that way after the Great Ones.

The old-time Foitani strode along at a pace that suited them fine, which meant it was uncomfortably quick for Jennifer. She kept up anyhow, and so did Greenberg. The Great One who was covering them looked as though he'd happily get rid of them if they slowed him down.

She looked around behind her, wondering if more imperial Foitani were is-

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suing from the central tower. They were, but by ones and twos rather than by hundreds and thousands as she'd feared. They were quite bad enough by ones and twos.

By the time the leading Great Ones neared the edge of the radius of insanity, both their human captives were panting and footsore. Another few kilometers like that, Jennifer thought, and she'd look forward to being shot. Her coveralls were soaked with sweat; it dripped from her chin and ran stinging into her eyes.

Unlike the Foitani from Rof Golan, the Great Ones seemed immune to sweat. They tramped down the processionway as if on parade. Jennifer's uneasy vision of old-time Foitani leading defeated aliens in triumph came back to her. All that made this seem different from a small-scale version of it was that they were walking away from the tower, not toward it.

Even after the processionway ended, the imperial Foitani strode grandly along. A gnarled shrub grew by their line of march. Jennifer thought nothing of that at first. Then she realized it meant they were out of the precinct of the Great Unknown, for no plants lived within it.

Ahead, the firefight between the Rof Golani and the Foitani from Odern continued. Both sides had to be going crazy, wondering what had happened to their fliers. Jennifer thought the Great Ones were crazy, too. She turned her head towards Greenberg and muttered, "Do they think they're bulletproof, or what?"

"I don't know," Greenberg muttered back, soft enough so as not to earn the wrath of their watchdog. "I know I'm not, though."

Just then, the communicator in his pocket spoke up in loud, clear, translated Spanglish: "Humans Bernard and Jennifer, this is Thegun Thegun Nug. You will tell me immediately who those strange Foitani with you are. You will also tell me whether they are in any way responsible for the difficulties our aircraft had encountered over the last few minutes."

That was Thegun Thegun Nug all the way, Jennifer thought: whatever he wanted, he ordered the humans to deliver *immediately*. He also had a gift for opening his mouth at just the wrong time.

The Great One who'd kept Jennifer and Greenberg from talking with each other snarled at them and held out his hand for the communicator. Greenberg gave it to him. He held it close to his face for a moment, as if figuring out how it worked. Then he spoke into it in sharp, insistent tones.

Silence stretched. Jennifer wondered how a Foitani translator system that was geared to handling Spanglish would deal with suddenly getting its own tongue back. After a moment, she also wondered how close the language the Foitani from Odern used really was to the speech of the Great Ones.

Evidently it was close enough, for Thegun Thegun Nug seemed to understand it. The first part of his reply came back in Spanglish: "We greet you, Great Ones, returned to the world at last after so long. We shall serve you to the best of our ability and obey you in all regards, for we—"

The translator program suddenly went

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out of the circuit. Thegun Thegun Nug's own voice came over the communicator. Even speaking for themselves, Foitani from Odern seldom sounded excited. Thegun Thegun Nug was no exception. "If I witnessed the Second Coming, I think I'd show a little more feeling than that," Jennifer complained to Greenberg.

"The Foitani have been waiting ten times as long as Christians," he answered. "Maybe after 28,000 years, some of the rush has gone out of it."

"Maybe," Jennifer said. But her own reference to the Second Coming rang a bell in the scholarly part of her mind. What rough beasts were these old-time Foitani, slouching out of the Great Unknown to be reborn? She looked up to the sky, which still had no fliers in it. She shivered. The old-time Foitani might be very rough indeed.

Somewhere much too close, a Rof Golani hand weapon barked. Bullets shouted past. Jennifer went flat and tried to claw holes in the ground with her nails. She couldn't call this combat, because she had nothing with which to shoot back. But by now she knew what to do when somebody started shooting at her. So did Greenberg, who might have hit the dirt a split second before she did.

One of the Great Ones was down, too, down and shrieking. His blood was even redder than Jennifer's. His comrades cried out. A couple of them stooped beside him to give what help they could. It wasn't much. His screams went on and on.

The rest of the imperial Foitani did as Jennifer and Greenberg had—they dove to the ground. But they were armed, and armed with weapons more terrible than any mere firearms. With dreadful thoroughness, they turned those weapons on one possible spot of cover after another, as far as the eye could see.

A few more bullets came their way, but only a few. They stopped all at once. The silence that settled round the Great Ones was punctuated only by the cries of their wounded comrade.

Jennifer didn't yet dare to raise her head, but she did turn to face Bernard Greenberg. "Looks like it's going to be the old-time Foitani and the ones from Odern against the Rof Golani," she said.

"I'd say the Rof Golani are in big trouble," he answered. He lowered his voice. "I'd say we are, too. I don't mean just you and me, I mean everybody."

"I know what you mean," she answered as quietly. "I've already decided I'm going to tell Pawasar Pawasar Ras that I'm sorry." But she suspected that by then, Pawasar Pawasar Ras would be happy to see the Great Ones out and loose, not afraid of them any more. Thegun Thegun Nug had all but groveled to them on the communicator, at least in the brief part of that conversation which had been in Spanglish.

The wounded Great One's shrieks shrank to gurgles. He had an amazing amount of blood in his body; the spreading puddle was a couple of meters wide. One of the other imperial Foitani spoke to him. He gasped out an answer. The second Great One touched his weapon to the wounded one's head. He jerked and lay still.

"What are they doing?" Jennifer

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said, more than a little sickened. "He just killed him. The old-time Foitani have to have the medical technology to save him. Otherwise, they wouldn't still be here after so long in cold sleep, if they use cold sleep. So why did he kill him instead of helping him or getting him back to the tower where he could be worked on properly?"

"Maybe he only stunned him," Greenberg said. "We don't know what all their weapons can do."

"That's true, we don't," Jennifer mentally kicked herself for jumping to a conclusion. Just because the Great Ones had done their level best to exterminate every Rof Golani Foitan within range of their weapons, that didn't have to mean they were as callous among themselves.

But everything she'd learned about the imperial Foitani argued that they might well be. Races with gentle, tender dispositions didn't make a habit—maybe even a sport—of genocide. They didn't fight Suicide Wars, either, for that matter. And the way the Great Ones tramped on and left behind the one who'd been shot argued that they had no further use for him. They were, as Jennifer had long since concluded, not nice people.

The communicator spoke up again. Jennifer caught Pawasar Pawasar Ras's name in the middle of a lot of unintelligible Foitani chatter. Her spirits rose slightly. Maybe the administrator's good sense would warn him not to trust the Great Ones too completely.

"Maybe," Greenberg said when she spoke that thought aloud; their keeper seemed more willing now to let the two humans talk. He didn't sound as if he believed it, though. He kept looking back toward where the old-time Foitan had been shot. He didn't believe the Foitan was just stunned any more either, then.

The sun set when the imperial Foitani were still a couple of kilometers from the research base. By the way they glared at the western horizon, they looked about ready to order it to come back up and keep lighting their way. Jennifer knew a moment's fear it might obey them, too.

But however great they were, the Great Ones had no Joshua among them. They did the next best thing: they surrounded themselves with glowing globes that filled their camp with a light about as bright as daylight.

"That's all very well if they don't have any enemies left out there," Greenberg observed, "but if they do, the only way I can think of to make themselves more conspicuous would be to paint 'shoot me' on their backs in big fluorescent letters."

In spite of everything that had happened through a long, exhausting, terrifying day, Jennifer found herself giggling. She dug out a plastic pouch of Foitani kibbles, and crunched a handful between her teeth. "These things had better have all the nutrients humans need in them," she said, "because I've used up just about everything that used to be in me."

"You and me both." Greenberg pulled off his shoes, stared at his feet. "I keep waiting for them to swell up right before my eyes."

"Me, too," Jennifer said. She shed her shoes, too, and sighed in exquisite relief as she wiggled her toes. "I didn't come out here set up to hike." She

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swigged from her canteen. She would have killed for a cold glass of beer; warm, rather stale water was at the moment a more than adequate substitute.

Greenberg also ate some Foitani people chow. He washed it down with his own water. "Better—a little better," he said. "If they're going to the research base tomorrow, at least they won't walk our legs off, Jennifer . . . Jennifer?"

Jennifer didn't answer him. She hadn't heard him. She lay sprawled on her side in the dirt, fast asleep.

The old imperial Foitani must have eliminated or at least intimidated the Rof Golani on the ground, for Jennifer woke up the next morning. At first, she wasn't sure she liked the idea; she felt almost as bad as she had after Thegun Thegun Nug stunned her.

She grimly went through a stretching routine she hadn't used since she was in the field on her last trading run. By the time she started to sweat, some of the kinks in her legs and back began to come loose. The Great Ones watched her with impassive curiosity.

Greenberg also needed limbering up after a rugged day and a night on the ground. When he was done stretching, he looked around for a bush to go behind. But when he started to go behind it, one of the old-time Foitani growled and lifted his weapon. Greenberg sighed. "Sorry about this, but I can't wait any longer," he said to Jennifer as he turned his back to her. She heard him open his fly.

"Don't turn around," she warned him. "In coveralls, this is a lot more inconvenient for me than it is for you." As she unfastened herself and squatted, she thought again that this was a problem Middle English science-fiction writers had ignored, especially for women. She wished she could ignore it herself. She also wished she could ignore the Foitani. As they had while she was exercising, they studied her now.

Relieved (and also relieved of her dignity), she got to her feet. "It's all right now," she told Greenberg.

"All right," he said, and turned around. "Shall we have a lovely breakfast of dry dog food?"

"Since our other choice is leaves and whatever Gilver uses for bugs, I suppose we might as well."

They crunched for a while. Jennifer watched the Great Ones while they watched her. They might have slept on featherbeds instead of hard dirt; not a single tuft of fur seemed out of place. Some of them wore belts with pouches. They took what looked like slabs of raw meat out of the pouches, shared them, and devoured them.

After a cautious pull at his canteen (who could guess when he'd get a chance to refill it?), Greenberg said, "I meant what I told you yesterday, you know."

"What did you tell me yesterday?" she asked, a little testily—far, far too much had happened yesterday. When his face fell, she remembered all at once what he'd told her. She felt herself turn red. "I'm sorry, Bernard. I know you did."

"And so?" he said.

It was a good question. Over the years, a lot of men had said they loved her, a lot more than she wanted to hear it from. To many of them, it meant noth-

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ing more than that they wanted to go to bed with her. She was already going to bed with Bernard, and it had been her idea as much as his. She knew that said something. But living with Ali Bakhtiar, in the beginning, had been as much her idea as his, too.

She shook her head. "Bernard, right now I just don't know what to say to you. I think maybe the only thing I ought to say right now is that this isn't really the time or place to say much of anything. You know I'm fond of you—or if you don't, I've been doing something wrong." She smiled wryly. "But love? I'm not even sure what love is. Let's talk about it later, when we can think straight and feel something besides being scared out of our minds."

"Fair enough," he said, his voice unreadable.

They wouldn't have had the chance to talk about it then, anyhow. The imperial Foitani, with the gift for timing all Foitani races seemed to share, chose that moment to break camp and start for the research base of the Foitani from Odern. They still didn't want the humans talking while they marched. A warning growl made that quite clear.

The Great One who had Greenberg's communicator used it to call the base. Jennifer heard Pawasar Pawasar Ras's name. That was all she understood of the conversation. She wished for some of the tricks to enhance recall that science-fiction writers had invented: memory RNA pills and who knew what else, all guaranteed to let somebody learn a language in twenty-four hours flat or your money back. Trouble was, nobody'd bothered with such things after effective translator programs came along. Trouble with that was, as she'd found more times among the Foitani than she cared to remember, take away the translator program and she was helpless without it.

Far off to the south, gunfire crackled. From several kilometers away, it sounded cheery rather than terrifying. The Great Ones grew alert when they heard it, but it wasn't close enough even for folk as aggressive as they to hose down the area with their hand weapons.

The breeze, a fickle thing, played with the marching Great Ones and wearily trudging humans, blowing sometimes from behind them but more often into their faces. The old-time Foitani ignored it; like their descendants from Odern, they were good at ignoring anything they didn't care for. Jennifer rubbed grit from her eyes as she tramped along. Stopping didn't seem like a good idea, not with that Foitan and his weapon right beside her.

She walked past a couple of emplacements the Foitani from Odern had built to protect the way to the Great Unknown. No one came out to greet the returning imperial Foitani. She looked down into one gun pit close by the side of the road. A blue Foitan lay inside, sprawled and dead.

"I hope Pawasar Pawasar Ras knows what he's doing, treating with the Great Ones," she whispered to Greenberg. She got another growl from the armed Great One for that, but no more, for it was the first thing she'd said since the day's journey began.

When the party of Great Ones came within a few hundred meters of the research base, Foitani from Odern emerged to meet them. Jennifer watched the old-

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time Foitani watching the blue successor race. She wondered what the Great Ones thought of them as compared to the insanely aggressive Foitani who'd developed on Rof Golan.

She still had trouble telling one Foitan from another, but thought she recognized Pawasar Pawasar Ras and Thegun Thegun Nug in the group that had come out of the base. All the Foitani from Odern bowed low and chanted at the Great Ones. Without the translator, Jennifer couldn't be sure, but she thought the chant was the same as the one her kidnappers had intoned when they bowed to the ancient ruins on Odern after they'd brought her there.

The gesture of submission seemed to have meaning to the imperial Foitani. They came out of the skirmish line in which they'd advanced and formed up into a single compact group. Once they were all together, they bowed too, though not nearly so low as the Foitani from Odern had.

After that recognition ceremony, ancient and modern Foitani walked toward one another. The two groups were only a few meters apart when the breeze stopped blowing into Jennifer's face. She knew a moment's relief—*no more grit in my eyes*, she thought.

The Foitani from Odern had been moving forward with every sign of the reverence they gave to anything that pertained to the Great Ones. All at once, they stopped short. They bared their teeth. Pawasar Pawasar Ras—Jennifer was sure now it was the project leader—growled something deep in his throat.

Without any more preamble than that, the Foitani from Odern roared and charged at the Great Ones.

For an incredulous half second, Jennifer gaped at the onrushing blue Foitani. Then Bernard Greenberg tackled her. A couple of Great Ones managed to get their weapons up before the Foitani from Odern crashed into them, but only a couple. Most had their deadly small arms torn or kicked from their hands before they could use them.

Even without weapons, the Great Ones were a match for the suddenly berserk Foitani from Odern. They smashed them to the ground with a savage skill for which battleball scouts would have paid millions. Jennifer and Greenberg tried to roll out of the way of the battling behemoths.

A Great One who hadn't been disarmed slew a pair of Foitani from Odern. Then, all at once, he ceased to be. Jennifer closed her eyes against a terrible glare that had already struck and vanished—an anti-ship laser, fired now at a ground target. Another old-time Foitan sizzled into nonexistence. A voice from the research base, amplified to a volume that approximated divine wrath, bellowed a command.

The imperial Foitani seemed better at giving orders than taking them. Another Great One fired in the direction from which the laser had come. Jennifer didn't know whether he took it out. Another laser, from a different position, cut him down. That bolt flew much too close to her. She felt a blast of heat, smelled ozone as if lightning had struck nearby. Only a few meters away, sandy ground bubbled into glass.

The amplified voice roared again,

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louder than ever. This time the Great Ones, those few left on their feet, spread their arms wide. The ones with weapons dropped them. Only a couple of Foitani from Odern were in any shape to keep fighting. Regardless of whether their foes had quit, they started to attack again. The voice from the base cried out once more, this time with different words. Reluctantly, the Foitani from Odern held back. One—Jennifer thought it was Pawasar Pawasar Ras—shouted what was plainly a protest. The voice from inside the base shouted him down.

More Foitani from Odern emerged. All of this group were heavily armed, with rifles similar to the ones the Rof Golani carried. An armored fighting vehicle also came forth from some concealed entrance and clanked toward the Great Ones. It carried a fat laser tube and a cannon whose muzzle seemed, to Jennifer's frightened eyes, to be about as wide as her head.

The armed modern Foitani advanced on the imperials who had come out of the Great Unknown. They were more than cautious but less than the bloodthirsty maniacs into which Pawasar Pawasar Ras's party had turned. Greenberg noticed that at once. "How come they don't want to tear the Great Ones limb from limb?" he said.

"The breeze is blowing from the base to us again," Jennifer answered. "Maybe they can't smell them any more."

"Maybe the Great Ones haven't had a bath in the last 28,000 years," he said.

Jennifer made a face at him. Taking advantage of the fact that nobody was going to point a gun at her for talking, she said, "Maybe they—"

The voice from the base boomed forth once more, this time in Spanglish: "Humans Bernard and Jennifer, this is Aissur Aissur Rus. I suggest you come into the base through the passage from which our soldiers have just debouched. They are ordered to let you pass through them. We would not want you to come to harm through staying too close to the *kwopillot* from the Great Unknown."

"The who?" Jennifer said at the same time as Greenberg said, "The what?" The translator program had missed a word. Maybe it didn't have a Spanglish equivalent, even an approximate one. That happened now and again with translator programs. Trouble was, when it did, the word that refused to translate was almost always vitally important.

Aissur Aissur Rus didn't answer either Greenberg or Jennifer. Neither of them felt like asking again—whatever *kwopillot* were, he'd made it clear it wasn't safe to be anywhere around them. The behavior of Pawasar Pawasar Ras had done a pretty good job of that, too. Both humans hurried to pass through the ranks of the Foitani from Odern. The big blue aliens ignored them, keeping eyes, attention, and weapons on the Great Ones.

The fickle breeze shifted again just as Jennifer was about to go down into the underground research base. Behind her, the Foitani from Odern bellowed in rage. A rifle began to bark, then another and another. Aissur Aissur Rus screamed for the soldiers to stop shooting, but they wouldn't stop. The Great Ones went down like ninepins. When they were all dead, the soldiers rushed forward to kick and beat at their shattered bodies.

Sickened, Jennifer turned away. The

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kibbles she'd eaten sat like a ball of lead in her stomach. She hoped they'd stay down. "Back inside the radius of doom, the old-time Foitani treated the ones from Rof Golan the same way," Greenberg said.

"I know," Jennifer said. That had been only yesterday. She shook her head in disbelief. "I didn't like that, either."

"Neither did I. Let's get away from the Foitani with guns before they decide we might make good targets, too."

She let Greenberg take her by the elbow, lead her down the passageway. As soon as they were at the bottom, Aissur Aissur Rus spoke to them in Spanglish once more: "Come immediately to the command center. The ceiling light will direct you."

Following the moving light like a will-o'-the-wisp, they soon came to the screen-filled chamber from which Aissur Aissur Rus had spoken. He said, "I congratulate you on penetrating the tower at the center of the Great Unknown, humans. But had I known it was filled with *kwopillot*, I would have agreed with Pawasar Pawasar Ras that it remain sealed forever. I thought them merely the stuff of legend and modern depravity. Would I had been right."

"What *are kwopillot*?" Jennifer demanded. Bernard Greenberg opened his mouth, closed it again. He'd evidently been about to ask the same question.

But before Aissur Aissur Rus could answer, Pawasar Pawasar Ras and Thegun Thegun Nug limped into the chamber. They were dirty and bloody and looked more like beasts of prey than intelligent beings. "*Kwopillot!*" Pawasar Pawasar Ras exclaimed. Had she not thought he'd tear her limb from limb, Jennifer would have kicked him.

Thegun Thegun Nug said something. Aissur Aissur Rus's translator turned it into Spanglish: "Filthy, reeking perverts! If the Suicide Wars were fought against them, suppressing them was worth the price."

"Aye, so it was," Pawasar Pawasar Ras declared. Aissur Aissur Rus didn't say anything, but he didn't look as though he disagreed, either.

"What are *kwopillot*?" Greenberg got the question out this time.

Word by word, the translator turned it into the Foitani language. That seemed to remind Aissur Aissur Rus and his colleagues that the humans were there. His answer, though, was less than helpful: "Never mind, human Bernard. They are practically extinct, and it is as well."

"No, they aren't," Greenberg said loudly. "Whatever they are, you may have murdered as many of them as came out of the tower in the middle of the Great Unknown, but how many do you think are still left in there? It's a big tower, you know, and it's awake or active or whatever you want to call it, thanks to us. What do you want to bet that more *kwopillot* will pop out of it soon?"

Aissur Aissur Rus, Pawasar Pawasar Ras, and Thegun Thegun Nug all bared their teeth at him. Thegun Thegun Nug growled something. Aissur Aissur Rus's translator turned it into, "What a terrible thing to say." Jennifer suspected the original had been rather more pungent.

Aissur Aissur Rus said, "Unfortunately, the human may well be right.

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We should make preparations on that assumption, at any rate. Those who came forth may have been *kwopillot*, but they were also Great Ones, with all the powers we have long believed the Great Ones held. If the *kwopillot* truly hold all the resources contained within the Great Unknown, how are we to resist them?''

''Better to ally with the Rof Golani than to risk such filth spreading through our sphere,'' Pawasar Pawasar Ras said.

Maybe he had just been indulging in rhetoric, but Aissur Aissur Rus took him up on it: ''An excellent suggestion, honored kin-group leader. Call them at once; we have already observed that they too know the proper response to this menace.''

''As you say, Aissur Aissur Rus.'' Pawasar Pawasar Ras went over to a communications panel, and started talking into it. Before long, the image of a gray-blue Foitan from Rof Golan appeared on the screen on front of him.

''What are *kwopillot*?'' Jennifer asked. It was the third time the humans had tried that question, and they were still without an answer.

''They are disgusting,'' Thegun Thegun Nug said. ''I go to wash their reek from my fur.'' He stalked off.

Jennifer turned to Aissur Aissur Rus. ''Will you please explain what's going on, and why you've all started killing each other on sight?''

Aissur Aissur Rus made a noise that might have come straight from a wolf's throat. The translator rendered it with a sigh. Jennifer had some qualms about the translation; nothing that sounded so—carnivorous—had any business being merely a sigh. Aissur Aissur Rus said, ''This subject is not easy for us to discuss, human Jennifer. It is also one we never thought could arise—as the Great Ones were believed to be extinct, surely the degenerate *kwopillot* had to be gone. Sadly, this now appears not to be the case.''

''So what are *kwopillot*, and why do you keep calling them such nasty names?''

''Wait a minute,'' Bernard Greenberg put in, his eyes lighting up. ''This has to do with sex, doesn't it? Otherwise you wouldn't mind so much talking about it.''

''You are, as usual, astute, human Bernard,'' Aissur Aissur Rus said with another of those bloodthirsty-sounding sighs. ''Indeed, the matter of the *kwopillot* does turn on sex, or more precisely on gender.''

He paused, plainly not eager to go on without being further prodded. Jennifer looked at Greenberg in open-mouthed admiration. His shot in the dark had struck home—had it ever! If the Foitani were anything like most other species, they'd find sex worth fighting about no matter how technologically advanced they were. All at once, the Suicide Wars had a rationale that made some kind of sense.

Aissur Aissur Rus still stood silent. He looked big and blue and unhappy. Jennifer said, ''May I ask, solely for the purpose of remedying my own ignorance, and with no desire to cause offense, what *kwopillot* do that other Foitani disapprove of?''

The variant of the trader's standard question paid off. Aissur Aissur Rus said, ''You know that my race is unusual among intelligent species, in that

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we are born female and become male after our thirtieth year, more or less."

"You said so, once, yes," Jennifer agreed. "I didn't think much of it. We humans have found that intelligent races vary widely. Also—again I speak without intending to cause offense—Foitani are not sexually interesting to humans."

"The converse also holds, I assure you," Aissur Aissur Rus replied at once. He waggled his ears. "I thank you, human Jennifer. You have given me an idea so vile to contemplate that beside it the depravities of the *kwopillot* fade almost—not altogether, but almost—into insignificance."

Aissur Aissur Rus was the only Foitan Jennifer had ever suspected of owning a sense of humor. If he did, it was a nasty one, and he didn't bother with trying to speak inoffensively. She tried to match him irony for irony: "I'm glad I've given you something new and revolting to think about. Meanwhile, though, you'd started to explain what *kwopillot* were."

"I had not started yet," Aissur Aissur Rus said. "Indeed, I approach the task with considerable reluctance. You may perhaps have observed that we Foitani are somewhat reticent in discussing matters which pertain to the reproductive process. The Middle English term for such affectation of reticence, I believe, is *Victorian*, is it not?"

Jennifer stared at him. "That is exactly the word, Aissur Aissur Rus. I've thought of it in connection to your people myself. Now I have another reason for wishing you hadn't kidnapped me—I'd love to have seen the research paper you would have turned in. If you didn't outdo all the humans in my class, I'd be amazed.

"As may be," Aissur Aissur Rus said. "That, however, is at present irrelevant. Rather more to the point, one of the reasons we are as reticent as we are concerning reproductive matters is that they are relatively simple to disrupt among us."

"And *kwopillot* choose to disrupt them?" Greenberg pounced.

"Exactly so, human Bernard. For unnatural reasons of their own, they choose through hormonal intervention in the egg"—which was the first Jennifer had heard of Foitani coming from eggs—"to produce creatures (monsters might be a better word) male from birth. Even more outrageously, those born properly female, again by means of hormones, opt to remain their initial gender. That is what it is to be a *kwopil*—to be or to have been of the wrong gender for one's age."

"Why would anybody want to do that?" Jennifer asked, though she doubted she would get a rational answer. When it came to sex and gender, few intelligent races were rational.

Sure enough, Aissur Aissur Rus said, "*Kwopillot* act as they do because, being afflicted with perversity themselves, they wish to have others with whom to share it."

"Wait a minute," Greenberg said. "Suppose you have a male, uh, *kwopil*. What happens after he gets older than the age at which he was supposed to turn male anyway. Isn't he pretty much normal from then on?"

"No," Aissur Aissur Rus said. "For one thing, the hormone treatments which made him a *kwopil* leave their mark: he

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never smells as a proper Foitan should. For another, how could he be normal even were that not so, when he has spent all his previous life in a gender unnatural to that phase?"

"I see your point," Greenberg said slowly. So did Jennifer. No matter how refined the surgical techniques that changed them had become, transsexual humans were often pretty strange people. That might be an even greater problem for the Foitani, where the alteration was made before an individual ever saw the light of day, and where there was no natural equivalent of, say, a ten-year-old male.

She asked, "How do you know these things, Aissur Aissur Rus? Are there still *kwopillot* among you? You said they were extinct."

"Sadly, I overstated," Aissur Aissur Rus admitted. "Every starfaring Foitani world knows them, and many of those still sunk in planet-bound barbarism. The modification techniques, as I said, are far from difficult. Depraved and wealthy individuals, anxious only for their own degenerate gratification, generally create the first ones on a world. But once there are *kwopillot* on a world, they make more like themselves. In a way, it is understandable—who else but others of their kind would care to associate with them?"

Jennifer and Greenberg looked at each other. They both nodded. Humans made genetically engineered sex slaves every now and again, too. A year didn't go by without a holovid drama showing that kind of lurid story. Jennifer didn't know whether to be relieved or depressed that another race could act the same way.

Pawasar Pawasar Ras was talking to the gray-blue Rof Golani officer. He spoke too softly for Aissur Aissur Rus's translator to pick up what he was saying, but Jennifer heard one word she understood: *kwopillot*. When Pawasar Pawasar Ras said it, the Rof Golani Foitan's red eyes opened wide. So did his mouth, displaying his large, sharp teeth. *The better to eat you, my dear,* Jennifer thought. But where before the Rof Golani had wanted only to attack the Foitani from Odern, now this one listened attentively to everything Pawasar Pawasar Ras had to say.

"They both hate these *kwopillot* worse than they hate each other," Greenberg said.

Jennifer quoted the title of a Middle English novel: "The enemy of my enemy—"

Greenberg knew the saying from which it had come. "—Is my friend. Yes." He turned to Aissur Aissur Rus. "Obviously the Great Ones knew of *kwopillot*, too. Did they feel the same way about them as you do?"

"There can be no doubt of it," Aissur Aissur Rus said. "Because we normally find it distasteful in the extreme to discuss such reproductive issues, the speculation is not published, but many, I think, privately believe the *kwopillot* problem to have been a possible cause of the Suicide Wars. I am one of those, and not the only one here at the base."

"What's the point of thinking if you don't publish?" Jennifer said. What she was thinking of was her fruitless search through the Foitani records on Odern. She'd never so much as heard the word *kwopillot* there, not even from Dargnil Dargnil Lin, who was supposed to be

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helping her learn about the Great Ones. She made a mental note to give him a good swift kick the next time she saw him.

Before Aissur Aissur Rus could answer her (if he was going to), Pawasar Pawasar Ras broke his connection with the Foitan from Rof Golan. When he turned and spoke directly to Aissur Aissur Rus, the latter's translator caught his words and turned them into Spanglish: "The barbarians have agreed to parley with us. Even they know the extent of the *kwopillot* menace."

"Excellent," Aissur Aissur Rus said. "All the resources we and they both can bring together will be important in eliminating revenge-minded *kwopillot* backed by the technological power of the Great Ones."

"You have stated my precise concern." Pawasar Pawasar Ras went on, "Humans Bernand and Jennifer, your presence will be required at this parley. You had the greatest and most significant contact with the denizens of the tower."

"May we go back to my ship first so we can rest and wash?" Greenberg asked.

"Rest and wash here," Pawasar Pawasar Ras said. "If further trouble erupts from the Great Unknown, this base is the most secure place on the planet. We would not want you to be lost before you have provided us with the information we need."

"What about afterwards?" Jennifer said. Pawasar Pawasar Ras did not deign to reply, from which she drew her own dark conclusions. Reluctantly, though, she admitted to herself that the Foitan administrator had a point. She wished the *Harold Meeker* was an armed and armored dreadnought instead of a thoroughly ordinary trading ship.

By Foitani standards, the chamber to which Aissur Aissur Rus led her and Greenberg was luxuriously appointed, which is to say that it had its own plumbing fixtures and a foam pad twice as thick as the one she'd enjoyed—or rather, not enjoyed—on her journey from Saugus to Odern. Aissur Aissur Rus took the door with him when he left, but Jennifer was sure the room was bugged.

Sighing, she walked over to what the Foitani used for a toilet. "Turn your back," she told Greenberg. "I hate this miserable excuse for plumbing."

"I know what you mean," he answered. "Still, given the choice between this and what the Great Ones had us do earlier today, I'll take this."

"Not my idea of a pleasant choice," she answered.

A little later, they both got out of their clothes and washed in the lukewarm washbasin water that was the only water they had. Greenberg shook his head as he examined his tattered overalls. "I should have insisted on going back to the *Harold Meeker*, for fresh clothes if nothing else."

"Too late to worry about it now," Jennifer scrubbed and scrubbed until most of the dirt came off her hide. She looked down at herself. Even clean, she was several different colors, most of them unappetizing. "With all these scratches and bruises and scrapes, I look more like a road map than a human being."

"A relief map, maybe. The terrain is lovely," Greenberg said. Jennifer

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snorted, not quite comfortably; even foolish compliments made her uneasy. Greenberg went on, "What do you think we ought to do now?"

She chose to think he was talking about the situation generally rather than the two of them in particular. She was too tired to worry about the two of them in particular. "Given the chance, I'd just as soon sleep," she said. "If we're going to be talking to the Rof Golani, we shouldn't be punchy while we're at it."

If he'd had anything else in mind, he didn't show it. He got dressed and lay down on the pad. Jennifer joined him a moment later. No sooner was she horizontal than exhaustion bludgeoned her.

"Wake up, humans!" The flat Spanglish from the translator was loud and abrupt enough to make sure they did just that. Jennifer found she'd snuggled against Greenberg while she slept, whether for warmth, protection, or no particular reason she couldn't say. The voice from overhead went on, "The delegation from Rof Golan has arrived. Your immediate presence at the deliberations is necessary."

"Yes, Thegun Thegun Nug," Jennifer said around a yawn.

A brief pause, then: "How do you know to whom you speak? The translator eliminates the timbre of individual voices."

"It doesn't eliminate personalities," she answered; let the order-giving pest make of that what he would. Whatever he made of it, he said nothing more. She asked Greenberg, "How long were we out?"

"A couple of hours," he answered after a glance at his watch. "Better than nothing, a lot less than we needed."

"Enough of your chatter," Thegun Thegun Nug said. "As I told you, your presence is required immediately."

Jennifer was fed up enough with his arrogance to tell him to take a flying leap, but a door opened in the wall just then. Behind it stood a Foitan with one of their nasty stunners. He gestured imperiously. "Charming as always," she said to the ceiling as she stood up. Thegun Thegun Nug did not bother answering.

The Foitan gestured again: *out*. He stepped back to make sure Jennifer and Greenberg could not get behind him. They followed a glowing ceiling light. He followed them. After a while, he rapped on a hallway wall. When the rap produced a door, he pointed through it. The two humans went in. The door vanished behind them.

Pawasar Pawasar Ras, Aissur Aissur Rus, and several other Foitani from Odern stood against one wall of the room. A smaller number of blue-gray Foitani from Rof Golan stood against the opposite wall. No one carried any weapons. From the way the two groups kept empty space between them, Jennifer got the feeling they'd fight with bare hands if they got too close together.

The Rof Golani turned their red eyes on the humans. Pawasar Pawasar Ras spoke; his translator passed his words to Jennifer and Greenberg: "War-leader Vomisa W Nhoj and his staff."

Vomisa W Nhoj took half a step forward to identify himself. He looked like a war-leader, especially if the war was to be fought with claws and fangs. When he spoke, his words had the howl-

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ing quality Jennifer had heard before from Rof Golani. Pawasar Pawasar Ras's translator abraded emotion from them: "You are the creatures who effected entry into the Great Unknown?"

"So we are," Greenberg said. "Your soldiers did their level best to kill us while we were in there, too."

Several Foitani from Rof Golan snarled as that was translated. Jennifer was glad they were unarmed. Vomisa W Nhoj spoke to Pawasar Pawasar Ras: "You are soft, blue one. You allow the vermin more license than even a person deserves."

Aissur Aissur Rus answered for his boss: "And because of it, Rof Golani, we have learned more than we would have with our usual straightforward approach to non-Foitani intelligences."

Vomisa W Nhoj's wordless snarl told what he thought of that. But in his own way he, too, was an officer and leader. "This is a parley, to seek information," he said, as if reminding himself. "Very well, creatures, inform me."

Having met Enfram Enfram Marf, Jennifer knew what the typical "straightforward" Foitani attitude toward other intelligent races was like. The Great Ones had shown it too, so Vomisa W Nhoj's version was less irritating than it might have been otherwise. She merely wished him into the hottest firepit in hell before she began telling what had happened over the previous couple of days. She and Greenberg took turns with the story. They must have been interesting, for Vomisa W Nhoj eventually settled down and listened just as if they had been Foitani.

At one point, he asked, "What is the mechanism that creates a ring of insanity around the Great Unknown?"

"We do not know that," Pawasar Pawasar Ras answered. "We have been trying to learn for many years."

Again, a little later: "How is it that you creatures were able to enter the central tower and we True Folk not only failed but also failed to perceive the existence of an opening?"

"I don't know how that happened, either," Jennifer said. "The Foitani from Odern also couldn't see the opening; I do know that."

"It is so," Pawasar Pawasar Ras admitted. "Vomisa W Nhoj, when the humans went inside the central tower our visual observations and the readings of our instruments reported that they were penetrating a wall which remained solid. Indeed, it did remain solid for your soldiers close by. The Great Ones seem to have mastered selective permeability of solid matter. How they did this, I cannot say."

"Selective is right," Greenberg said. "When we wanted to get out of the tower later on, the wall was solid for, or rather against, us, too."

"Tell me of the Great Ones," Vomisa W Nhoj said. As best they could, Jennifer and Greenberg did. When they finished, the Foitan from Rof Golan made a ripping-cloth noise the translator rendered as a thoughtful grunt. "To think they truly have survived, to think their knowledge is available for hunting down."

"I see two problems with that," Jennifer said.

"You are not a Foitan. Who cares what you see?" Vomisa W Nhoj said.

"If you don't, why are you asking

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me questions?'' Jennifer asked. Vomisa W Nhoj's lips skinned back from his teeth. Jennifer ignored him and went on, ''First, now that the Great Ones are awake again, they may be interested in hunting what you know, too. And second, they're *kwopillot*, so how do you propose to deal with them?''

Vomisa W Nhoj turned to Pawasar Pawasar Ras. ''There can be no doubt they are *kwopillot*?''

''None.'' Pawasar Pawasar Ras spoke to the air: ''Bring in the evidence.'' A door opened in the wall opposite the one by which Jennifer and Greenberg stood. Two Foitani from Odern dragged in the torn corpse of a Great One. Pawasar Pawasar Ras addressed Vomisa W Nhoj: ''Judge for yourself.''

Vomisa W Nhoj's nostrils flared. The snarl he had given Jennifer was as nothing next to the one he unleashed now. The gray-blue Foitani from Rof Golan who were with him echoed the cry. He said, ''Aye, that is the harshest *kwopil* reek I've ever had the misfortune to encounter. They were all thus?''

''Every one we encountered,'' Pawasar Pawasar Ras answered.

''Then every one needs to be tied down in the hot sun and disemboweled. That's how we keep the menace of *kwopillot* from spreading among us,'' Vomisa W Nhoj declared.

Jennifer gulped. She hoped the Foitani from Odern would denounce Vomisa W Nhoj for the bloodthirsty barbarian he was. But Aissur Aissur Rus said only, ''We use lethal injections ourselves. Still, the principle remains the same.''

Greenberg whispered, ''I wonder what *kwopillot* do to ordinary Foitani when they're the ones in power.''

''Nothing good, I'd bet,'' Jennifer whispered back.

''You Oderna are too soft with your aliens,'' Vomisa W Nhoj said to Pawasar Pawasar Ras. ''There they go, plotting who knows what between themselves.''

''Repeat yourselves, humans Jennifer and Bernard, loud enough for the translator to pick up your words,'' Pawasar Pawasar Ras said.

Before Jennifer could repeat herself, a Foitani voice started shouting from a ceiling speaker. The translator brought her the gist of the announcement: ''Honored kin-group leader, radar reports the central tower of the Great Unknown has lifted off from the surface of Gilver and is performing as a spacecraft. We have visual confirmation as well. Please advise.'' ■

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By Tom Easton

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If you have fond memories of classic SF, you'll love **Lifeline,** by Kevin J. Anderson and Doug Beason. The authors posit an American moonbase, Clavius; an American corporate satellite, Orbitech 1, in the L-5 Lagrangian niche; a Soviet satellite, Khibalchich, also at L-5; and an L-4 habitat, the Aguinaldo, built by the Americans and turned over to the Philippines in exchange for permission to keep military

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bases in the islands on Earth. The Filipinos enjoy the services of chief scientist Luis Sandovaal, a geneticist who has devised wall-kelp, a fast-growing but foul-tasting food source, and sail-creatures that fly around within the habitat and can be triggered into biological solar sails in space. Orbitech 1 has 1500 researchers concentrating on making such things as super-lipstick and weavewire, a superstrong monomolecular filament. The Soviets are developing suspended animation for a Mars mission, though the presence of KGB agents suggests something more ominous. Clavius has just received the corps of construction engineers withdrawn from the Orbitech 2 project in protest of Soviet demands.

And the nuclear mushrooms begin to sprout on Earth, destroying all hope of resupply for the various spacers. The Soviets dive into suspended animation, hoping thus to ride out the crisis. Orbitech 1 is ruled by Brahms, an efficiency expert who is mad enough to take his efficiency ratings seriously, and one of his underlings realizes what this may mean. Duncan McLaris talks the pilot of the sole remaining shuttle into taking him and his small daughter to the Moon; the ensuing crash landing leaves him the sole survivor, wracked by guilt. Brahms shortly carries out a ten percent RIF (reduction in force) by spacing 150 of his lowest-efficiency personnel in an effort to make supplies last longer. Orbitech 1 becomes a pit of despair, paranoia, suspicion, hopelessness, and tyranny, and McLaris's selfishness actually seems justified.

The future looks dark. There is not enough food. There is no way for one colony to reach another. But then the Filipinos figure how to make a package of wall-kelp hit the Moon near Clavius and how to use a sail-creature to carry one young man, Ramis, to Orbitech 1 with more wall-kelp. Suddenly there is hope, though it is not enough to remove Brahms's tyranny. Ramis decides that Khibalchich is close enough for an EVA to reach, carrying a weavewire lifeline that can later be used as a guide for travellers. He leaps the gulf and finds the suspended animation tanks. More hope. On the Moon, the Orbitech 2 engineers devise a way to use weavewire to carry packages between the Lagrange points and Moon. More hope. The Filipinos develop their sail-creatures a little further. Still more hope.

But by now a Soviet woman, the researcher responsible for suspended animation, the late commander's lover, is awake and very pissed off at the American interference with her plans and dreams. Soon she realizes that Khibalchich conceals a dark secret that may bring everything, for everyone, crashing down in ruins.

Happy endings are *de rigueur*, even if they have to be forced a little bit. Getting there is more than half the fun, and that is certainly true here. The posing and solving of apparently insuperable problems keeps the reader involved in that classic way. At the same time, the characters are real enough to engage the reader's sympathy (though they are not drawn terribly subtly). And at the end there is a very real sense of resolution and satisfaction.

The main drawback—and it's part of what makes this book so classic in form—is the pace. All the marvels that save the spacers are devised and deployed in less than three months. The speed is essential, since Orbitech 1 starts off with only four months' food, but that deadline did get moved back by Brahms's RIF and the Filipinos's wall-kelp. Stretching out the timeline would have made the story a little more believable.

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But that's a quibble. Even if you agree with me, you'll still enjoy the tale.

Another tale in the classic vein is **Double Planet,** by John Gribbin and Marcus Chown (developed from a short story Gribbin had here in 1984). It is late in the 21st century, after an L-5 disaster has crippled a space program that included a moonbase and a nuclear "incident" destroyed a world full of computers and put the Reunited Nations on top of the world heap to cope with famine and rebellion. Now astronomers spot a new comet, plot its orbit, and project that it will come so close to Earth that they cannot tell whether or not it will strike the planet. Or so the RN's science adviser, David Kondratieff, tells the RN's dictatorial chief, Yevgeny Ustinov, in his pitch for a mission that will use the last spacecraft to reach and turn aside the Dragon. Ustinov approves—what else can he do?—and Kondratieff begins to set the machinery in motion, telling almost no one what he really has in mind. Meanwhile, terrorists and revolutionaries see potential advantage in the world's apparent plight.

The tale is of threatened disaster, conspiracy, Machiavellian manueuverings, technical daring and vision, and heroism. The people—from Kondratieff to mission commander Frances Reese to the American hacker who uses an illegal home computer to analyze the Dragon's path—are ones you might like to know. The melodrama is more that of the situation than that of overblown characters or rhetoric, and it thus rings convincingly true.

Ask any full-time writer: Writing is a job, and like other jobs it gets to you after a while. You want to give it a rest, cut loose, send it up. You want to add mustaches to the faces on all the bank's bills, do the evening news starkers, show up on stage with an out-of-tune guitar,[1] deliver papers folded as giant airplanes, do the Kelvin Throop thing, or even say "This is not a peepshow!" when your jewelry-store customer says, "I wanta watch." Or maybe, if you're Jack Chalker, Mike Resnick, and George Alec Effinger, you write **The Red Tape War.**

This is a round-robin novel, meaning that Resnick wrote Chapter 1, introducing Class 2 Arbiter Millard Fillmore Pierce, his snippy computer, and a galaxy thoroughly snarled in red tape (fill out Form No. X-28035-c in quadruplicate, submit to headquarters, and wait six weeks for reply before sneezing), getting Pierce lost in space and under attack by an alien dreadnaught filled with lizards who plan to conquer the galaxy, and introduce their toothsome—er, that's *toothy!* toothsome comes in later—leader as Millard Fillmore Pierce, and passing the situation on to Chalker with a "Let's see you get out of this one!"

Chalker explains the lizards as from a parallel universe, as enwrapped in red tape as the first Pierce's folks, says they think they're human, introduces Ms. Toothsome, better known as the six-gun totin' Honeylou Emmyjane Goldberg (so named by Resnick two chapters later), and says Pierce's computer has fallen in love with the aliens' computer and the two are about to elope.

Effinger's turn, and the book begins to chat conspiratorially with the reader. (This is the column speaking now. That Easton is so full of hot air it's a wonder the post office makes Davis Publications pay any postage at all for this magazine. But I'll tell you what: Be patient with him for just a moment more, and I'll

[1]Could anyone tell these days?

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tell you about the latest book by Arthur C. Clarke.) It even begins to solicit calls and letters somewhat a'la interactive TV to determine what happens next. And then it introduces a pair of microscopic gasbags named Pierce (Millard Fillmore, of course) and Arro (put 'em together and what have you got?), scouts for another invasion force.

And so on. Chalker, Resnick, and Effinger beat their joke pretty thoroughly to death, but the end result is still funny and fluffy and snide. They were much less concerned with making *Red Tape War* a serious tale than with having a romping good time, and it shows. They made fun of science fiction, each other, themselves, the book they were writing, and even their readers. They played coy with the talking book routine. Sometimes they got a little desperate. But they managed to roll their ball of tangled twine toward a resolution of sorts, and with surprisingly few loose ends. With a little luck, you'll have nearly as much fun as the authors did.

Arthur C. Clarke's first solo novel in years is **The Ghost from the Grand Banks.** Set in the years just before the centennial of the sinking of the *Titanic*, it concerns the schemes of two groups who wish to raise the ancient liner from the deeps off the Grand Banks. At the same time, it offers glimpses of a world afflicted by rising sea level, increasingly volatile weather, crowding, and new plagues. There is much of Clarke's famous technological and scientific awareness—from the difficulties computers will face in crossing the 1999-2000 line to Mandelbrot sets, the use of fire extinguishers to scare off giant octopi, the effects of colossal underwater earthquakes, and more. There are the people he loves best, the scientists and engineers, movers and shakers in the worlds of ideas and technological deeds. There are the ideas themselves, and quite enough carefully thought out detail for at least one novel.

It's also an intriguing tale. But it's not what you might expect. *Ghost* reads less like a real novel than like its ectoplasmic shadow, an outline if you will. The numerous brief scenes seem lacking in development. The timeline gets confused at least once, when he introduces a character whose wife is lost in Mandel-land without making it clear that the scene's present is not at all as early in the sequence of events as the context makes it seem. Important events get glossed over or even ignored.

It's Clarke, right enough, but call it minor Clarke and spend your twenty bucks on four or five paperbacks. They'll help you kill the time until this one is a paperback too.

Many long years ago, Gordon Dickson made one of his many splashes with *The Dragon and the George*, in which a modern fellow was magicked into the body of a parallel-world dragon and had to fight the forces of darkness. The dragons, of course, called humans "georges" and were rather annoyed at the propensity of georgish knights to go looking for dragons to slay. This particular george, yclept James Eckert, turned out to be a nice guy, and once he had rescued his true love he settled into the local castle quite happily.

Now Dickson gives us the sequel, **The Dragon Knight.** Eckert has just developed an annoying tic: from time to time, he turns into a dragon and back again. The explanation proves to be that since he is a magician who is not using his magic, the Accounting Office has taken it upon itself to cause him to tap his account spontaneously and at random. The cure is no less than to ap-

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prentice himself to the mage Carolinus and learn how to use his magic at will. Yet Eckert is barely begun upon this path when word comes that the King of England's son has been captured by the French. The nobles of the realm are summoned to the rescue. Eckert must go. He must, in fact, invade the chateau of a powerful, wicked sorcerer, use his magic to survive and bring out the prince, and then once more defeat the forces of darkness.

It's an amusingly clever book but it feels far more conventional than did *The Dragon and the George*. That is, it smacks of a thousand predecessors, though we must recognize that many of those predecessors were inspired by the earlier book. We can thus safely say that the same *Dragon Knight* would have seemed much more enchanting if Dickson had written it a few years sooner.

Charles de Lint's **Ghostwood** is a sequel to his earlier fantasies, *Ascian in Rose* and *Westlin Wind*. To some extent, it stands alone, but some acquaintance with the earlier volumes will enhance your pleasure.

Tamson House occupies an entire block of Ottawa, where it both serves as a gateway between Earth and the Otherworlds and attracts and serves as refuge for creative artists, New Age mystics, modern witches, and other generally congenial types. It has a guardian, the spirit of Jamie Tamson, heir to the eccentric fellow who built the place, and strong friends who can move in and out of the Otherworlds at will. Sara spends most of her time in a realm occupied by mysticized American Indians. Esmeralda, who commands winds, lives in the House, as does Emma, who cannot learn or accept the nature of her own Autumn Gift. There are Tim, who cultivates the garden at the House's heart; Cal; Blue; Juliana; and more.

There is also an enemy, an aged fellow who covets the power inherent in Tamson House's soul for the power and immortality it can give him and his wife, if only he can seize it. He sees his moment when Jamie dares to leave the House to wander among the Otherworlds, and he attacks. As he begins to drain the House's vitality, Jamie detects the disaster and manages to send a cryptic "Help!" to Sara and yank the House and its occupants into the Otherworld after him before he dissipates. The House reveals its change in status as elements of the primordial forest thrust through its floors and the forest's "angry thoughts"—enraged boars and bears, strange humanoids—attack the intruder. Its occupants then struggle to survive the onslaught, to figure out what has happened, and to find a way to rescue Jamie, return to Earth, and defeat the villain.

Aided by Whiskey Jack, the coyote-headed representative of whatever powers lie behind the Otherworlds and all their mysteries, they succeed. Of course they do. They also suffer changes in perception, enhancements of sense, and acceptances of fate, and even though the Autumn Gift, perhaps because of its ultimate rejection, remains more than a little mysterious, the end result is quite satisfying. Certainly it is far more satisfying than the bulk of wizards-and-dragons fantasy, even than the Dickson book.

As Frederick Fichman's **SETI** gets under weigh, six-year-old Sam Alexander is playing radio ham. One of his signals goes off into space, eventually to reach Tau Ceti and provoke a reply. In the meantime, his parents disappear in their small plane, he goes to live with

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his San Diego aunt and uncle who let him spend his inheritance as he wishes, and he builds a large collection of computers, radios, and signal analyzers devoted to searching the sky for signs of intelligent life. Then, one day, he finds it: an unexpected spike in the radio spectrum, a message that his computer promptly decodes into English, a message addressed directly to him, Sam Alexander.

Naturally enough, this interferes with Sam's high school studies. It interferes worse when Sam takes the signal to JPL, where his father once worked, and shows it to assistant director Richard Redden. Redden promptly gets greedy, finds out where Sam lives, and sneaks in at night to steal Sam's marvelously effective signal analyzer and trash everything else. Sam catches him at his dirty work but can't save his analyzer; he does holler bloody murder, though, and Redden is on the run, unable to claim the credit for the device and the signal discovery as he had planned.

Now JPL is on Sam's side. The Russians have caught wind of the message and are interested. The aliens have positioned a magenta-glowing pyramid in space right over Sam's home. More messages promise a meeting with a UFO in the California desert. Redden is still loose and scheming. And Sam is struggling to escape the government juggernaut on his back.

It sounds exciting, doesn't it? And I didn't even mention the car and dune buggy chases. So why did I find it so tedious? It might have something to do with the exceeding plainness and unsubtlety of Fichman's prose style.[2] Or with the level of detail which, while it seems accurate and makes every scene quite clear (except the sex scene, which falls just shy of the *** mark for coyness), seems far in excess of what is necessary to do the job and surely adds an extra hundred pages to the book.

I don't think you'll like it either.

Tom Holt did such a nice job with *Who's Afraid of Beowulf* awhile ago that I was quite happy to see his **Expecting Someone Taller** in my mailbox, even though the St. Martin's hardbound appeared in 1987. Like the *Beowulf*, it confronts a literary rendition of ancient myth with modern reality. When nebbish Malcolm Fisher hits a badger with his car, the badger begins to talk, revealing itself as Ingolf the Frost Giant, ruler of the world, possessor of the Tarnhelm and the Ring of the Nibelungs. "So here, Malcolm. Take 'em. You got me, fair and square, and to the victor go the spoils. The cap will let you turn into anyone or anything or take you anywhere you wish. The ring—rub it, and you're rich. But do watch out for Wotan, Alberich, and the Rhinedaughters. They *all* want it back."

As the new ruler of the world, Malcolm turns out to be such a nice guy that war and famine disappear, economies boom, and everyone goes around with a sappy smile on his or her face. Meanwhile, Wotan is hunting for the ringbearer, the Rhine daughters are trying to seduce him, and . . . Surely you get the picture. Good fun, even if the point about niceness saving the world does seem a little farfetched.

Like many series that have gone on too long, even though they may remain popular with readers, Christopher Stasheff's Warlock series has grown weak, with each succeeding volume more insipid than the last and offering less to recommend it. Stasheff's latest

[2] If I were to liken it to the old "See Dick run" abominations, I would be indulging in just a wee bit of hyperbole.

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entry is **The Warlock Rock,** and it is very little more than an excuse for every pun related to rock music that the author can think of. The world of Gramarye is being overrun by rocks that emit rhythmic music (rock music, get it?). Some of the rocks are soft, some hard. Some secrete acid. Some have a metallic tone. Some are even disc-shaped. All draw Gramarye's youth away from home, family, morality, and responsibility toward mindless self-indulgence.

Suspecting a nefarious plot, presumably by the future anarchists who have long striven to destroy Gramarye, the Warlock, Rod Gallowglass, and his family set out to track down the rocks' origin. Their journey exposes them to all the varieties of rock and rock music, leads them past several kinds of self-indulgence (can you guess what "getting stoned" has to mean?), and finally . . .

You won't be surprised, except perhaps by the sort of music and musicians Stasheff opposes to the evil forces of rock.

And no, I can't say I dislike the book because I love rock. I don't. Nor do I believe that rock is the work of the devil, complete with satanic messages embedded in the music and lyrics (often revealed only when you play the tape or record backwards). I dislike the book because it panders to the credulous and simple-minded of our society, and at far greater length than the joke (which is kinda cute, really) can justify. It would have worked much better as a short story.

Last December, I gave Frank A. Javor's *Scor-Sting* somewhat less than a rave review. Now here's his second Eli Pike adventure, **The Ice Beast,** and if it shares some of the previous book's weaknesses—notably a shortage of clues to what is really going on—and if it is still pretty conventional SF adventure, it is also something of an improvement. Pike, who has one of the licenses to carry a camera that is so rare in his post-war galaxy, roams the worlds looking for stories whose reporting will make him prosperous. In *Scor-Sting*, he heard of a marvelous racing beast being developed on the ice-world Thul. Now on Thul, looking for the beast, he finds a horde of military types combing the icy wastes, obviously looking for something, and a mysterious man and woman, Baran and Claire, who want his camera to help them find a "matrix mining" machine, which uses matter-transmitting technology to remove materials such as metals from a planet's crust. The machine's side-effects include earthquakes and the removal of heat from its environs.

When they find the clue they seek, they take Pike's camera and dump him in the wilderness to freeze. Fortunately, Pike is soon captured by natives among whom is a woman, Meta, who even though Claire had said she and Meta were sisters, insists several times that Claire is not her sister. In due time, after suitable adventures, Pike and the natives find the machine and foil the villains, and Pike escapes, presumably for a third adventure.

It's not a fatal defect, but it is annoying that Javor leaves a few loose ends. He never lets his readers in on the link between Baran and the official searchers, which he exploits in an attempt to get Pike out of his hair, nor on just what is the relationship between Meta and Claire. I suspect he needs an attentive editor.

Slow Dancing Through Time is a collection of fourteen SF, fantasy, horror and cross-genre stories by Gardner

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Dozois in various collaborations with Jack Dann, Michael Swanwick, Susan Casper, and Jack C. Haldeman II, taken one and two at a time. With the stories are a foreword by Michael Bishop, introductions by Pat Cadigan and Dozois, and several essays in which the collaborators describe how the process worked; one of these essays, Jack Dann's "Running Wild," is as lovely a portrayal of the "Stop worrying and get on with it!" key to productive writing as you will ever see. The stories themselves are generally provocative, sometimes bizarre or fluffy, always deft and smooth. They are also "slick" in the sense that most sold promptly to magazines such as *Playboy*, *Penthouse*, and *Omni*. They include "Down Among the Dead Men" (with Dann), about a vampire in a death camp; "Golden Apples of the Sun" (with Dann and Swanwick), concerning selling computers in elfland; "Slow Dancing with Jesus" (with Dann), the touching account of how Jesus takes a misfit girl to the prom; "Time Bride" (with Dann), about some of the nastier side-effects of a time-viewer; "Snow Job" (with Swanwick), about a time-traveler trying to score some cocaine from a con man; and more.

Recommended. It's a "no-regrets" purchase.

* * *

Niekas ("nothing" in Lithuanian) Publications recently sent me three of their latest offerings. **Andre Norton: Fables & Futures,** edited by Anne Braude, is a collection of essays on the works of one of the founders of modern science fiction and fantasy. The contributors include the editor, Edmund R. Meskys, Fred Lerner, Diana L. Paxson, Don D'Ammassa, Pat Mathews, Ruth Kyle, Sandra Miesel, Marion Zimmer Bradley, and Norton herself, among others. There's a time-line of Norton works, a bit of biography, some interesting analysis, and a good deal of applause.

James Anderson's **The Illustrated Bradbury,** with several stark graphics by Larry Dickison, is a structuralist analysis of four stories from *The Illustrated Man* ("The Veldt," "Kaleidoscope," "Zero Hour," and "The Rocket") aimed at showing that what Bradbury writes is really neither science fiction nor fantasy but a new genre all his own. The pamphlet is both short—its contents the equivalent of a single journal article rather than a monograph—and slender (4.25" x 11").

Anthony S. Magistrale's **Obsessions,** illustrated by Robert H. Knox, is 13 poems, evocative and dark, packaged in the same physical format as the Anderson pamphlet. I enjoyed it. ■

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brass tacks

Mr. Schmidt:

Your editorial "Bag Limit" (August, 1990) brought back memories of grocery shopping in a less "disposable" time. It wasn't all that long ago, either.

I grew up on a Blue Ridge mountain farm in the sixties and early seventies, and grocery shopping was a major event for our family. Soon after moving out to the farm, my mother discovered that "Mom and Pop" grocers were not the answer to economically feeding a family of six—the rural grocers' prices were high and the selection was small. Her solution was an Army post commissary nearly a hundred miles away (both my parents were veterans). And so, monthly grocery shopping would begin the day before, with us kids cleaning out the old station wagon (you have no idea, until you have lived on a working farm, what or who gets hauled in a station wagon) while my mother phoned the commissary and asked them to place various perishables we didn't grow, and (if the milk cow was dry) twenty or so gallons of milk in deep freeze to prevent spoilage on the long trip. The next morning we'd start early, filling an entire '64 station wagon with groceries took hours in a place that stocked shelves with cardboard boxes of cans whose only labels were smudged stamps of "beans, navy" or "corn, creamed," particularly with one or more small children trying to help. The sales tape from the cash register was such fun—even with totals of less than a hundred dollars, it was generally ten feet long and good for all sorts of childhood mischief. Finally, there was the bagging—we would bring up the wagon and unload and unfold the dozens of paper bags carefully saved from previous trips. My mother would supervise the packing for the long trip home ("make two layers, please, these heavy things on the bottom") and the greatest unpacking efficiency ("frozen stuff by the door, all together"). The bag boys would pay very close attention to her instructions, because commissary baggers worked only for shoppers' tips. In our case, I'm sure that most of the baggers' tip came from the money the commissary refunded her for bringing her own bags.

Today, military commissary baggers still work only for tips, but the incentive to recycle shopping bags is gone along with the unlabeled cans and cardboard boxes. I'm not sure how universal the refund for bringing your own bags was then, but the statistics in your article suggest that making it universal now would make a significant dent in both grocery store overhead and landfill volume requirements. And what about the volume of toxic wastes produced during the manufacture of the bags? Or the resources consumed? Wow! Let's all ask our local grocery chain to institute such a policy and see what happens.

I doubt anyone would be unemployed by such a move, or any other trend toward longer lasting goods. As one who keeps cars a very long time, I know that my "classics" require many more hours of maintenance than they required to build originally. Since American auto manufacturers refuse to support their

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products with parts after ten years or so, many small businesses have started up to fill in the gaps on cars that are popular and durable. If durability were a high priority to the American auto manufacturers instead of an occasional accident, some of the new car assembly workers would shift into parts manufacturing, refurbishment, and retrofitting older cars with new innovations while others would tackle problems we currently don't have the resources to solve. (This has already happened in the aircraft industry.) The only losers would be the bankers, who wouldn't be collecting exorbitant amounts of interest on biennial or triennial new car loans. Maybe they would start doing something useful, like being innovative about financing small businesses with ideas for handling toxic wastes or construction in low-income areas or some other thing they don't do nowadays.

But what about taking jobs that require no thinking away from people who can't think and thus have no other options? Recent history shows that automation of tedious, simple jobs (the only kind we can automate) has *not* resulted in fewer jobs overall, but more and different jobs. People with no skills are displaced temporarily, but people tend to rise to needs and expectations—how many people never complete high school or go to college because there are so many jobs that require little or no thought or knowledge? I've read that even the most educated among us use only a fraction of our brain's potential. We need to learn how to motivate or teach low achievers to use this untapped potential, not waste other resources on keeping them busy at a low achievement level. One very encouraging trend: businesspeople get very involved in local schools when their workers' educational needs diverge from what the schools are producing!

A friend of mine who manufactures painting robots replies to the cocktail-party accusation of automating people out of work with "I don't automate jobs that people *should* be doing. I automate tedious, boring, filthy jobs that kill people." He is referring to the toxic paint vapors and the repetitive, unthinking nature of painting cars on an assembly line. I suspect that this work environment differs little from that in a paper or plastic grocery bag plant. The thought of this alone was enough to motivate me to fish that wad of plastic grocery bags I tossed after yesterday's shopping trip out of the trash!

Thank you, Mr. Schmidt, for a fascinating editorial that has (for me, at least) converted a mundane item like grocery bags into a trigger for profound social thoughts. Grocery shopping will never be the same again.

KRISTIN FARRY

Houston, TX

Dear Dr. Schmidt:

I agree very strongly with your editorial in favor of using cloth shopping bags as a conservation measure in which everyone can participate.

You may be interested to know that one of our local commentators on CBS has recently urged this activity. But when he first mentioned it, I did not know where to get such bags, although, come to think of it, the bags given out by the various PBS channels might serve pretty well.

Soon after hearing the suggestion on TV, I found that one of the local supermarkets was offering stout canvas bags for sale, but had run out of their supplies because there was such a run on them. They have reordered, and I now have a couple. They are wonderful

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because they hold twice as much as the large paper bags, and the stout handles make them so much easier to carry.

Meantime, I have heard of other places to get bags if one needs them: EarthSave, at 706 Frederick Street, Santa Cruz, CA, 95062-2205, has canvas bags for $9.95 apiece; and Seventh Generation, in Colchester, VT, 05446-1672, has string bags for $4.25 apiece.

MARGARET M. BISHOP

Sunnyvale, CA

Dear Stan,

There is one aspect of bags that you did not touch on in your editorial, "Bag Limit."

The bags that enter our household rarely end up as *useless* trash. They are used to confine and "organize" the trash which enters the house through other avenues. Paper bags are useful for the computer room and are used as trash receptacles for the disposal of carbons, note paper, and other such disposables. Plastic bags are used to line the kitchen trash bin so that disposables that contain liquids do not leak through and cause us to use extra detergents and water to wash out the trash bins frequently.

It might be worthwhile to point out that trees are a renewable resource, that just one company relying on wood for its products replants trees at a rate exceeding one billion per year, and that there are far more acres of woodlands in the United States today than there were fifty years ago.

A considerable saving in paper and the trees it comes from could be made by eliminating the "junk mail" we all receive daily. Most of ours goes into a paper bag that we keep by the table where we sort all such incoming. Much of it isn't even opened, particularly that which heralds itself as IMPORTANT if there is no return address. The saving in paper could be far more significant. Naturally, the individuals that eke out a living from the preparation and mailing of such material can rationalize that their contribution to the economy is important. Hopefully, some of them could be retrained to produce something more useful.

JOHN HAROPULOS

Rockville, MD

Dear Stan:

Re "Bag Limit," (August 1990), I must assume that you are a married man not functional in the kitchen, or perhaps you live with your mother. I have no idea what the Europeans you mention did or do, without bags, but I can tell you in no uncertain terms that I can't live without 'em.

Consider: what do you do with slimy broken eggshells, with gristle and bone, plate-scrapings? and other unmentionables which any housewife could tell you about? Even if you were willing to chuck this stuff unadorned into a can, your garbage disposal crew is not likely to appreciate it! And then how do you clean the can? If you are fortunate enough to live in a part of the country where they don't always tell you there's a drought, you can't use the hose, etc., and again, where there are no freezing temperatures which would immobilize the hose, what about the *dreck* you wash out of the can? Where does it go?

No Sir! Let us keep our plastic bags. There are some which claim to be biodegradable. If they're not, then let's make some that are.

If the day should come when man-made microbes can be introduced into the garbage to convert it (into what?) then what will we do with the converted stuff, how will we dispose of *that?* I think mankind will always need garbage bags, as long as civilization endures;

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what we also need is a creative solution to the waste problem, not a shoot-from-the-hip "instant answer" from someone of whom I expect much better.

DOUGLAS MCGARRETT

Jamaica, NY

I'm terribly sorry to disappoint you, but I haven't lived with my mother for nigh onto 30 years, my wife and I share kitchen chores equally, and I'm generally considered very *functional in the kitchen. Now that we've disposed of your wild conjectures about me, please allow me one about you: Don't you* eat *any of your groceries?*

Of course there are, as you say, good uses for bags, especially plastic ones. I use them, too. But I don't need anywhere near as many to get rid of the remains as the stores want to give me to bring the stuff home in the first place. I've taken to recycling many of them just to keep the durn things from piling up to the ceiling.

I never claimed that nobody should ever *use plastic or paper bags, or that reusable bags were a* complete *"creative solution to the waste problem." I did claim, and still claim, that the number of paper and plastic bags could be greatly reduced, and that reusables can be a worthwhile* part *of a CSTTWP.*

Dear Dr. Schmidt;

Thanks for another fine and thought-provoking editorial: "Bag Limit" in the August issue. I wholeheartedly agree that in an economy based on robotics, means should be found to distribute the wealth generated by the machines. Simply hoping that a free market economic system will somehow evolve a socially tolerable way of doing this feels somewhat irresponsible. Perhaps governments should buy bonds in robotics firms and recycle the interest into social programs. People will still need something to do—for reasons of mental health if not economics. Grants to art galleries might be increased and publishers subsidized.

Since a literate, intellectually aware person has many more options than the converse, the quality of our public education becomes even more crucial.

But we're still a long way from having robots doing everything, so the efficiency of any system which uses human beings as one of its working parts is an important economic and environmental concern. As an example, there would probably be no *net* environmental benefit if people, say 5% of the time, forget to bring a bag and drive back home to get one.

The system engineering secret is to set things up so that most people will instinctively do the right thing. Trying to train people to act against their own nature is like Sisyphus rolling the stone up the hill: yes it can be done, but it's an unending task. Rest for a moment and the stone rolls back down and you have to start all over again.

As a public service, I'd like to point out that most places that recycle newsprint also take brown paper. We've recycled our paper bags for years without ecological guilt feelings. (We also use them to wrap boxes for mailing, Halloween costumes, painting, etc.) Recycling is, to a first approximation, employment neutral: jobs lost in mining and forestry are transferred to running recycling centers.

A lot of those plastic bags will stand many use cycles, and some of them are thin enough to fold up into your wallet, briefcase, or handbag. Now if retailers would only offer a discount for bringing your own bag!

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GERALD NORDLEY
25861 Cherryhill Dr.
Boron, CA 93516
Some do, but more could.

Dear Dr. Schmidt,

I want to congratulate you and Dr. J. Kevin Steele for the fact article "New Hopes for a Very Old Disease: Cancer Therapies for the 1990s." It was an excellent article.

The story "Something in the Air" by Grey Rollins was a good, honest read reminiscent of some of the stories out of the '60s. I could just picture Kelly Freas's illustrations and a cover to accompany the story.

I don't think the real world would work that way, though. Especially not in a situation closer to a ship at sea than a town's. Government and its police power would be throwing a lot more monkey wrenches into Beno's pie than Weber managed.

About ten years ago I was copyediting a manuscript on power co-generation for CRC Press. In general, the author was describing the benefits and usefulness of electric power co-generation. There was, however, one major drawback. In many states (and if my memory serves, New York was one of them) a co-generator of electricity (a large company using its waste heat to run steam turbine generators, for example, or a planned community doing the same) could not send their excess power into the local utilities grid. This was not because of any technical problem, but a legal one. The utilities plain out didn't like the competition or the requirement to pay for the power. The solution was to *make the co-generator permanently responsible for* x *amount of power sent into the grid*. This is fine so long as the company is operating with its original equipment and power needs, and as long as the co-generation equipment runs. However, production methods and economies change. Enough companies were caught by this trap, and forced to continue as a power supplier long after it became a minus rather than a plus on the ledger sheet, that the overall effect on co-generation was disastrous. The Moon people would clamp down even harder and more harshly, I fear. I hope this letter was of interest to you and Mr. Rollins.

WILLIAM MARCH
Ft. Lauderdale, FL

Dear Dr. Schmidt,

In the October issue, a letter from Arthur Sherburne, Hollis, NH, reported on a study of contemporary longevity compared to that of eras past. He concluded with the request that anyone having similar studies contact him. I tried but the letter bounced with "insufficient address."

I checked back in the issue and found that some letters have complete addresses *with* ZIP code, and others, like Hollis's are quite incomplete. *Analog* readers are inherently interesting people and may wish to exchange information. You could facilitate this by using complete addresses acceptable to the USPS.

I am enclosing the letter in the hope that you can forward it to him. Incidentally, my vote for the most fascinating piece in the past year is Poul Anderson's *"Uncleftish Beholding."*

WILLOUGHBY MOYER
Box 71
Creamery, PA 19430
Our normal policy, unless otherwise requested, is to print the complete address if and only if *the author includes it with his or her name* at the end of the letter—*in other words, as if it were part of the signature. Future letter-writers, please take note!* ■

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a calendar of analog upcoming events

3-5 May
CHIMERA 2 (small Illinois SF conference) at Hyatt Regency Woodfield, Schaumberg, Ill. Guests of Honor—John Crowley, David G. Hartwell, Gene Wolfe. Registration—$40. Info: Chimera 2, % Meida, 730 Fair Oaks, Oak Park IL 60302.

3-5 May
CONTRAPTION (Michigan SF conference) at Hilton Hotel, Troy, Mich. Guest of Honor—Frederik Pohl. Fan Guests of Honor—Robert Hillis & Liz Gross. Info: Contraption, Box 2285, Ann Arbor MI 48106. (313)542-0526.

3-5 May
WISHCON 1 (Star Trek™ convention) at Springfield, Mass. Info: Wishcon 1, Box 476, Northford CT 06472.

10-12 May
MISCON 6 (Montana SF conference) at Best Western, Missoula, Mont. Guest of Honor—Barbara Hambly. Registration—$16 until 15 April, $20 thereafter. Info: W. MT SF Conventions, Box 9363, Missoula MT 59807. (406)549-1435.

17-19 May
KEYCON 8 (Manitoba SF conference) at Winnipeg, Man. Guest of Honour—Gordon R. Dickson, Artist Guest of Honour—Adrian Kleinbergen, Fan Guest of Honour—Ron Gillies. Info: WINSFA, Box 3178, Winnipeg MB R3C 4E6 Canada.

17-19 May
OASIS 4 (Orlando area SF conference) at Gold Key Inn, Orlando, Fla. Guest of Honor—Robert Asprin, Artist Guest of Honor—Don Maitz, Fan Guests of Honor—Bob & Ann Passovoy, TM—Rusty Hevelin. Registration—$17 until 15 April, $20 at the door. Info: OASFiS Treasurer, Box 616469, Orlando FL 32861-6469.

24-27 May
DISCLAVE (Washington, D.C. area SF conference) at Hotel Sheraton Greenbelt, New Carrollton, Md. Guests of Honor—Lewis Shiner and Alicia Austin. Registration—$25 until 30 April, $30 at the door. Info: John T. Sapienza, Jr., Box 677, Washington DC 20044-0677.

29 August-2 September
CHICON V (49th World Science Fiction Convention) at Hyatt Regency, Chicago, Ill. Guest of Honor—Hal Clement; Artist Guest of Honor—Richard Powers; Editor Guest of Honor—Martin H. Greenberg; Fan Guests of Honor—Jon & Joni Stopa. Registration—$125 until 15 June 1991. Supporting—$30 through 15 July 1991; not available thereafter. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Chicon V, Box 218121, Upper Arlington OH 43221-8121.

8-14 September
VOLGA-CON (International SF convention on the Volga). Sponsored by SF Club "The Winds of Time" and the Youth Association ATOM. Info: Volga-con, % Boris A. Zavgorodny, Volgograd-66, Poste restante, 400066 U.S.S.R. Telephones: 34-74-62, 34-74-64, 34-44-09, 34-86-56.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices six months in advance of the event.

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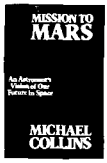

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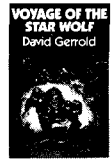

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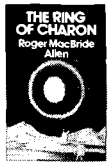

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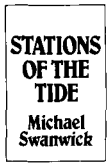

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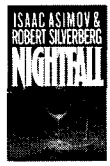

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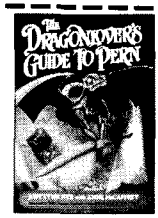

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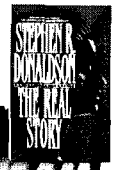

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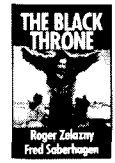

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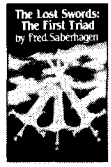

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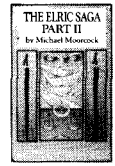

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